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# Scientific and Technical Aerospace Reports

*A Semimonthly Publication of the National Aeronautics and Space Administration*

## 01 AERONAUTICS (GENERAL)

**N76-14018#** Advisory Group for Aerospace Research and Development, Paris (France).
**THE EFFECTS OF BUFFETING AND OTHER TRANSONIC PHENOMENA ON MANEUVERING COMBAT AIRCRAFT**
Jul. 1975 276 p refs
(AGARD-AR-82) Avail: NTIS HC $9.25

A number of papers were presented dealing with various aspects of buffeting, its causes, and its effects on maneuvering combat aircraft. Some of the subjects discussed include: operational problems at transonic speeds, human factors engineering, flow distribution at transonic speeds, dynamic response under buffeting conditions, stability and control, flight tests and wind tunnel techniques, and effects of configuration factors. For individual titles, see N76-14019 through N76-14031.

**N76-14019** Royal Aircraft Establishment, Bedford (England).
**THE OPERATIONAL PROBLEMS ENCOUNTERED DURING PRECISE MANEUVERING AND TRACKING** **c05**
B. I. L. Hamilton *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 1-8 (For availability see N76-14018 05-01)

A summary of the main events that occur in air combat and affect its maneuvers and handling limitations was provided. The basic phases and conduct of air combat were first reviewed. The following phenomena that may affect precise maneuvering were defined and described: buffeting, wing rock, wing drop or 'roll off', nose slice or 'yaw off', nose wander or 'snaking', pitch up, and departure. All these phenomena can occur in transonic flight and some of them may be found at the lower Mach numbers, where air combat is usually conducted after a protracted engagement. Other factors influencing air combat maneuvering are: control forces, harmonization, and pilot induced oscillations, displays, and workload. The use of the following systems in tracking was described: automatic flight controls and stability augmentation, direct lift control and direct side force control, reaction controls. Y.J.A.

**N76-14020** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
**AIRCREW CAPABILITIES AND LIMITATIONS** **c54**
R. N. Slarve *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 9-14 (For availability see N76-14018 05-01)

The pilot factors that can influence aircraft tracking precision during maneuvering flight and the effects of sustained and vibratory accelerations on human performance were reviewed. The effects of various values of buffeting accelerations on vision were presented. It was pointed out that the effect of sustained acceleration on tracking is of far more importance than that of vibration in the current operational environment. Degradation effects of the following factors on pilot performance were discussed: noise, temperature, fatigue, psychological motivation, personal equipment, man-machine interface/control dynamics and configuration. It appears that the best vibration alleviation techniques primarily involve adequate pilot restraints and seating design to minimize excessive relative cockpit-pilot motion.
Author

**N76-14021** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**FLOW FIELD ASPECT OF TRANSONIC PHENOMENA** **c02**
B. Monnerie *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 15-20 (For availability see N76-14018 05-01)

The aerodynamics aspects of flow field over a wing in transonic maneuvering flight were reviewed in order to investigate the problem of buffeting. The case of a two-dimensional airfoil was first presented, followed by a discussion of three-dimensional flows. It was shown that most transonic troubles, and particularly buffeting, are due to the presence of more or less extended regions of separated flow. These are directly or indirectly related to the shock waves which form on the aircraft in the transonic speed regime. Prediction of what will occur in flight must be based on wind tunnel tests in view of the difficulty to theoretically predict flows with separated regions in the general case. Taking into account the continuous increase in flight Reynolds numbers due to increasing aircraft size, there is a need for higher Reynolds numbers wind tunnels.
Author

**N76-14022*** Advisory Group for Aerospace Research and Development, Paris (France).
**DYNAMIC RESPONSE OF AIRCRAFT STRUCTURE** **c05**
*In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 21-44 (For availability see N76-14018 05-01)
(Contract NAS2-6475)

The physical and mathematical problems associated with the response of elastic structures to random excitations such as occurs during buffeting and other transonic phenomena were discussed. The following subjects were covered: (1) general dynamic system consisting of the aircraft structure, the aerodynamic driving forces due to separated flow, and the aerodynamic forces due to aircraft structural motion, (2) structural and aerodynamic quantities of the dynamic system with special emphasis given to the description of the aerodynamic forces, and including a treatment of similarity laws, scaling effects, and wind tunnel testing, and (3) methods for data processing of fluctuating pressure recordings and techniques for response analysis for random excitation. A general buffeting flutter model, which takes into account the interactions between the separated and motion induced flows was presented. Relaxations of this model leading to the forced vibration model were explained.
Author

**N76-14023** Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
**STABILITY AND CONTROL STATUS FOR CURRENT FIGHTERS** **c08**
W. G. Williams and J. L. Lockenour *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering

Combat Aircraft Jul. 1975 p 45-53 (For availability see N76-14018 05-01)

The current state-of-the-art of stability and control technology for maneuvering and precision tracking was discussed, including basic aerodynamics and aerodynamic stability and control, flight control system concepts, and methods of prediction and analysis. It was shown that the maximum useable maneuvering capability of present fighter aircraft is often limited to 'g' levels below the maximum aerodynamic lift capability by stability, control and handling qualities degradations. In addition, handling qualities degradations often prohibit precision tracking although gross maneuvering may still be possible. Automatic flight control systems (stability augmentation and command augmentation) are being employed to correct many of the bare airframe deficiencies and additional capability is being provided by advancements in the fire control systems. Author

**N76-14024** Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

**STABILITY AND CONTROL POTENTIAL FOR FUTURE FIGHTERS** **c08**

J. L. Lockenour and W. G. Williams *In* AGARD The Effect of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft 1975 p 54-62 (For availability see N76-14018 05-01)

Advanced stability and control concepts aimed at further improving maneuvering and precision tracking were presented. The proposed new modes of control, methods of generating the required forces and moments necessary to produce the motions, flight control system concepts to implement the maneuvering modes, and the additional impact of pilot factors were discussed. Methods of prediction and analysis were also presented, and recommendations were made regarding the concepts and areas of analysis which are considered to be most important. Author

**N76-14025** Advisory Group for Aerospace Research and Development, Paris (France).

**BUFFET DEFINITION AND CRITERIA** **c02**

*In its* The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 63-83 (For availability see N76-14018 05-01)

Two areas related to aircraft buffeting were discussed: wing and tail buffet, and bomb bay buffeting. In the first area, basic definitions were given, followed by buffeting criteria for fighter and transport aircraft, classification of wing flow and buffeting for various types of wings, buffet onset and the severity of buffeting, and tail buffeting. It was concluded that (1) for bubble flows, the largest excitation is found just upstream of the reattachment point, (2) for slender wings with sharp leading edges the buffeting is light but just measurable, (3) for swept wings buffeting measurements must be made on rigid models. Bomb bay buffeting was defined as the specific dynamic behavior of an aircraft when excited by forces of random and harmonic nature due to flow separation in open bays or cavities. A remarkable large change in mean pressures occurs for bays with a length/depth ratio of about six, for which drag reises abruptly. Y.J.A.

**N76-14026** Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

**BUFFET ANALYSIS** **c02**

P. J. Butkewicz *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 84-90 (For availability see N76-14018 05-01)

The methods available for transonic buffer analysis were reviewed. The analysis methods were divided into two groups: experimental model testing including associated empirical prediction methods, and semi-empirical or theoretical procedures which require some flow field calculations. Due to the complexity of the transonic flow about wings experiencing unsteady separation, wind tunnel testing is the primary tool for obtaining detailed information about the buffet intensity. A serious problem however exists in applying the results to full scale due to improper boundary layer modelling at the relatively low test Reynolds numbers. A buffet onset prediction method suitable for theoretical analysis was outlined and is primarily applicable to thick, aft loaded airfoils which display a significant pressure rise from the shock and trailing edge and which therefore have a tendency for rear separation. Author

**N76-14027** Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

**BUFFET FLIGHT TEST TECHNIQUES** **c05**

P. J. Butkewicz *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 91-98 (For availability see N76-14018 05-01)

Buffet instrumentation and flight test techniques were discussed. Details of the instrumentation installed for buffet tests of a F-106A aircraft were given. In general, flight instrumentation for buffet tests should include: static pressure taps, total pressure and boundary layer rakes, accelerometers, strain gauges, aircraft attitude sensors, high speed camera and wing tufts. Particular attention must be paid to the application of wing tufts for flow visualization and for the mounting of the camera. The schedule used in buffet flight testing should incorporate that sequence of aircraft configurations and Mach-altitude conditions which will provide the most rapid collection of data based on: (1) the time required to attain the desired aircraft configuration and test condition, and (2) the aircraft modification time required for the subsequent configurations. Author

**N76-14028** Royal Aircraft Establishment, Bedford (England).

**LIMITATIONS IN THE CORRELATION OF FLIGHT/TUNNEL BUFFETING TESTS** **c05**

D. G. Mabey *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 99-104 (For availability see N76-14018 05-01)

Some possible sources of discrepancies between flight and wind tunnel buffeting measurements were discussed. The single, most serious causes of discrepancies is probably the failure to represent on the model the development of flow separations on the actual aircraft. The best way to improve future predictions is to test as large a model as possible, including the repesentation of gaps, surface roughness, etc., at as high a Reynolds number as possible, and then to insist on an extensive flight program. Other sources of discrepancies include: flight test measurement errors, visualization of areas of separated flows, influence of tunnel characteristics on model buffeting, measurement of buffeting. Author

**N76-14029** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).

**INFLUENCE OF CONFIGURATION FACTORS ON BUFFETING** **c05**

H. Max *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 104-107 (For availability see N76-14018 05-01)

Data concerning the effects of the geometrical configuration parameters, Reynolds number, external stores and supercritical wing layout of an aircraft on its buffet boundaries and the buffet intensities was presented. The following geometrical parameters were considered: wing aspect ratio, taper ratio, sweep angle, relative maximum thickness of the wing root section, and relative maximum camber of the wing section. The effects of these parameters on buffeting were shown graphically. An equation was given from which the light buffet lift coefficient may be estimated for a given wing at specific transonic Mach numbers and Reynolds numbers. Author

**N76-14030** Aeritalia, Turin (Italy).

**IMPROVEMENT OF AIRCRAFT BUFFET CHARACTERISTICS** **c05**

G. Bucciantini *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 108-110 (For availability see N76-14018 05-01)

A series of provisions which can be taken to improve the buffet characteristics of an aircraft were described. These include maneuver slats and flaps, strakes, aerodynamic fixing (notch, sawtooth, fence, etc.), and vortex generators. The effects of these devices were shown graphically. A separate discussion on the possibility of tailplane buffet and suitable remedial actions was also given. Author

**N76-14031** Advisory Group for Aerospace Research and Development, Paris (France).

**CONCLUSIONS AND RECOMMENDATIONS** **c03**
*In its* The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 111-112 (For availability see N76-14018 05-01)

General conclusions and specific recommendations on aircraft buffeting problems were presented. These include the need for: (1) a total system analysis to determine the effects of buffeting during maneuvering flight, (2) improved methods of viscous flow field and separation prediction, (3) comparing results from existing buffet onset prediction with wind tunnel and flight test data to determine their range of applicability, (4) better understanding of wind tunnel perturbation effects, (5) understanding of high speed stall progression, (6) identification of the interaction between the random aerodynamic driving forces and the structural response forces, (7) understanding the basic and interacting phenomena on existing and emerging fighters, and (8) isolating the effects of the various parameters more clearly, broadening the spectrum of the various parameters, and giving a better understanding of the physical process of buffeting. Author

**N76-14032#** Advisory Group for Aerospace Research and Development, Paris (France).
**APPROACH AND LANDING SIMULATION**
Oct. 1975 68 p refs
(AGARD-R-632) Avail: NTIS HC $4.50

Realism, validation, and standardization of flight simulators are discussed. External disturbances and visual and motion cues are evaluated as to their effect on pilot performance. Filter design for the von Karman spectrum and pitching moment coefficient model for Boeing 747 aircraft are appended. A bibliography with 58 references is included. For individual titles, see N76-14033 through N76-14039.

**N76-14033** Advisory Group for Aerospace Research and Development, Paris (France).
**APPROACH AND LANDING SIMULATION, INTRODUCTION** **c03**
*In its* Approach and Landing Simulation Oct. 1975 p 1-3 refs (For availability see N76-14032 05-01)

Historical notes on flight simulation are presented, progressing from simplified and rudimentary displays to today's sophisticated simulators. Primarily nonhardware aspects of simulation are discussed. J.A.M.

**N76-14034** Advisory Group for Aerospace Research and Development, Paris (France).
**ELEMENTS OF APPROACH AND LANDING SIMULATION** **c03**
*In its* Approach and Landing Simulation Oct. 1975 p 3-4 (For availability see N76-14032 05-01)

In simulations of the approach and landing flight regime, aircraft models are simplified by the absence of significant aerodynamic effects of varying Mach number, and only in the case of the very large, very flexible airplane are aeroelastic effects rigorously considered. In STOL and VTOL aircraft, widely varying interactions between aerodynamics and propulsion are encountered in the range of speeds appropriate to approach and landing. The importance of mathematical representation of atmospheric perturbations and the aircraft's response to them is discussed. Simulator hardware elements are reviewed, including all the mechanisms that provide the pilot with means to input control commands to the computer system model of the aircraft, and to assess the aircraft's response to either his inputs or other excitations. J.A.M.

**N76-14035** Advisory Group for Aerospace Research and Development, Paris (France).
**EXTERNAL DISTURBANCES** **c03**
*In its* Approach and Landing Simulation Oct. 1975 p 4-14 (For availability see N76-14032 05-01)

External disturbance models are used to test the pilots' reactions to given situations and to test the controllability of particular aircraft. Wind profiles, wind shear, and atmospheric turbulence are used in the simulation. The power spectra due to von Karman and to Dryden are discussed for turbulence simulation. A cross power spectra is also considered, relating the turbulence velocities in different directions as zero. Various causes of errors in ILS guidance systems are included, along with irregularities in runway conditions. J.A.M.

**N76-14036** Advisory Group for Aerospace Research and Development, Paris (France).
**AIRCRAFT CHARACTERISTICS** **c05**
*In its* Approach and Landing Simulation Oct. 1975 p 14-15 (For availability see N76-14032 05-01)

The types of data and the degree of detail used in modern simulations are discussed for large subsonic jet transports and powered lift STOL transports. It is shown how aircraft characteristic models will differ depending on the significant aerodynamic, structural, and propulsion effects of the particular aircraft. J.A.M.

**N76-14037** Advisory Group for Aerospace Research and Development, Paris (France).
**VISUAL AND MOTION CUES** **c09**
*In its* Approach and Landing Simulation Oct. 1975 p 15-19 (For availability see N76-14032 05-01)

Limitations of both day and night landing scenes used in a flight simulator are discussed. These limitations include field of view, resolution, depth of focus, display, terrain model, and dynamic performance. Motion cue constraints are examined for both rotational and linear motion. J.A.M.

**N76-14038** Advisory Group for Aerospace Research and Development, Paris (France).
**SIMULATION DEVELOPMENT, VALIDATION AND PILOT LEARNING** **c54**
*In its* Approach and Landing Simulation Oct. 1975 p 19-28 (For availability see N76-14032 05-01)

Views and experiences are presented, regarding the processes and procedures used to develop confidence in a simulation; overall interactions of the various elements in approach and landing simulation are discussed. Achieving confidence in a simulation through the demonstration of its acceptability by simulating an existing known aircraft is emphasized. The significance of the pilots' learning process is demonstrated, as well as their experience level with a specific simulation in the development of their confidence in that particular simulation. J.A.M.

**N76-14039** Advisory Group for Aerospace Research and Development, Paris (France).
**CONCLUDING REMARKS** **c03**
*In its* Approach and Landing Simulation Oct. 1975 p 28-61 refs (For availability see N76-14032 05-01)

The attempts at realism during flight simulation are discussed. Validation and ample training of pilots are stressed. Little standardization is noted among simulator testing and evaluation. The main weak elements of flight simulation, motion and visual cues, are also considered. A bibliography with 58 references is included. J.A.M.

# 02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

**N76-14040** Ohio State Univ., Columbus.
**A CASCADE IN UNSTEADY FLOW Ph.D. Thesis**
Francis Richard Ostdiek 1975 277 p
Avail: Univ. Microfilms Order No. 75-26635

Pressure distributions and pressure histories are determined on both surfaces of an airfoil in a cascade while it is undergoing a sinusoidal variation in angle of attack. A low speed, wind tunnel was constructed with a stationary five-blade cascade in a three by ten inch test section. The airfoils were biconvex circular arc with 10% thickness and 12 deg turning and were spaced at 2.3 inches. Each surface contained ten static pressure ports. These signals along with tunnel side wall statics and upstream velocity were recorded on FM Tape, digitized, and reduced on a digital computer. The pressure fluctuations over most of both surfaces were near sinusoidal and the cyclic average

showed little dependence on frequency or velocity. The pressures on both surfaces were adjusted by slow-moving waves and showed only a small change in phase angle with increased frequency. Dissert. Abstr.

**N76-14041** Georgia Inst. of Tech., Atlanta.
**DETERMINATION OF THE STRUCTURAL DYNAMIC CHARACTERISTICS OF ROTOR BLADES AND THE EFFECT OF PHASE ANGLE ON MULTIBLADED ROTOR FLUTTER Ph.D. Thesis**
Vadrevu Ramachandra Murthy 1975 232 p
Avail: Univ. Microfilms Order No. 75-26214

Frequency response concepts are reviewed. A transmission matrix is used to obtain the dynamic characteristics of rotating blades for combined flapwise bending, chordwise bending and torsion, and five of its subcases. The orthogonality relation that exists between the natural modes of coupled flapwise bending, chordwise bending and torsion is derived. An integrating matrix method is used to obtain the dynamic characteristics of rotating systems for flapwise bending and torsion. Comparisons are made between the transmission matrix approach and the integrating matrix method. The effect of phase angle on flutter speed for a two bladed rotor is determined. For this purpose a uniform and untwisted rotor blade with coupled flapwise bending and torsional degrees of freedom is considered. The transmission matrix method is used for obtaining the natural vibration characteristics of the system. An unsteady aerodynamic theory is used to obtain the compressible aerodynamic loading. Dissert. Abstr.

**N76-14042*#** Vizex Inc., Amherst, N.Y.
**ANALYSIS OF MEASURED AIRFOIL PRESSURE DISTRIBUTIONS**
Raymond A. Piziali Oct. 1975 48 p refs
(Contract NAS1-13274)
(NASA-CR-144901; VIZEX-CR-75-6) Avail: NTIS HC $4.00 CSCL 01A

A method for evaluating the Glauert coefficients from airfoil pressure distributions is investigated. The linear operating range of the airfoils in steady-state and periodic operating conditions are considered. A rational method for quantitatively characterizing airfoil pressure distributions relative to their geometry and aerodynamic operating environment is developed. The characteristics of the airfoil operating environment is determined from its measured pressure distribution. Author

**N76-14043*#** Cincinnati Univ., Ohio.
**NUMERICAL STUDY OF SUPERSONIC TURBULENT FLOW OVER SMALL PROTUBERANCES Semiannual Progress Report, Jul. - Dec. 1975**
A. Polak and M. J. Werle Dec. 1975 16 p refs
(Grant NsG-1208)
(NASA-CR-145924) Avail: NTIS HC $3.50 CSCL 20D

Supersonic turbulent boundary layers over two-dimensional protuberances are investigated, using the numerical finite difference alternating direction implicit (ADI) method. The turbulence is modeled mathematically. The turbulence is represented here by the eddy viscosity approach. The turbulent boundary layer structure as well as an interest in thick boundary layers and much larger protuberance heights than in the laminar case lead to new difficulties. The problems encountered and the means to remove them are discussed. Author

**N76-14044*#** Marquette Univ., Milwaukee, Wis. Dept. of Mechanical Engineering.
**ATTITUDE DETERMINATION OF A HIGH ALTITUDE BALLOON SYSTEM. PART 2: DEVELOPMENT OF THE PARAMETER DETERMINATION PROCESS**
N. J. Nigro and A. F. Elkouh [1975] 65 p refs
(Grant NsG-1025)
(NASA-CR-145958) Avail: NTIS HC $4.50 CSCL 01A

The attitude of the balloon system is determined as a function of time if: (a) a method for simulating the motion of the system is available, and (b) the initial state is known. The initial state is obtained by fitting the system motion (as measured by sensors) to the corresponding output predicted by the mathematical model. In the case of the LACATE experiment the sensors consisted of three orthogonally oriented rate gyros and a magnetometer all mounted on the research platform. The initial state was obtained by fitting the angular velocity components measured with the gyros to the corresponding values obtained from the solution of the math model. A block diagram illustrating the attitude determination process employed for the LACATE experiment is shown. The process consists of three essential parts; a process for simulating the balloon system, an instrumentation system for measuring the output, and a parameter estimation process for systematically and efficiently solving the initial state. Results are presented and discussed. Author

**N76-14045*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**A STOL AIRWORTHINESS INVESTIGATION USING SIMULATIONS OF REPRESENTATIVE STOL AIRCRAFT Final Report**
Robert Rumold (Systems Technol., Inc., Mountain View, Calif.), John M. Lehman (Systems Technol., Inc., Mountain View, Calif.), Robert L. Stapleford (Systems, Technol., Inc., Mountain View, Calif.), Robert K. Heffley (Systems Technol., Inc., Mountain View, Calif.), Charles S. Hynes, and Barry C. Scott (FAA, Washington, D. C.) May 1975 253 p refs
(Contract NAS2-7926)
(NASA-TM-X-62498; FAA-RD-75-197) Avail: NTIS HC $9.00 CSCL 01A

A simulator study of STOL airworthiness criteria for approach and landing was conducted using a series of different aircraft models. These models were selected to isolate a single parameter or characteristic for evaluation. Specific areas included were: an evaluation of speed margins, a flight path margin evaluation, flare and landing technique, the effects of touchdown zone constraints, an evaluation of two different turbulence models, an investigation of flight path/airspeed cross coupling, and a study of the effects of short-term flight path response. A detailed description of the simulation, and the data obtained are included. These data include performance measures, pilot commentary, and pilot ratings. Author

**N76-14046*#** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**FLIGHT TEST INVESTIGATION OF THE VORTEX WAKE CHARACTERISTICS BEHIND A BOEING 727 DURING TWO-SEGMENT AND NORMAL ILS APPROACHES Final Report**
L. J. Garodz Atlantic City, N. J. NAFEC Oct. 1975 139 p refs Prepared jointly with Natl. Aviation Facilities Exptl. Center
(NASA-TM-X-72908; FAA-NA-75-151) Avail: NTIS HC $6.00 CSCL 01A

A series of flight tests were performed to evaluate the vortex wake characteristics of a Boeing 727 (B727-200) aircraft during conventional and two-segment ILS approaches. Flights of the B727, equipped with smoke generators for vortex marking, were flown wherein its vortex wake was intentionally encountered by a Lear Jet model 23 (LR-23) or a Piper Twin Comanche (Pa-30); and its vortex location during landing approach was measured using a system of photo-theodolites. The tests showed that at a given separation distance there were no differences in the upsets resulting from deliberate vortex encounters during the two types of approaches. Timed mappings of the position of the landing configuration vortices showed that they tended to descend approximately 91 meters (300 feet) below the flight path of the B727. The flaps of the B727 have a dominant effect on the character of the trailed wake vortex. The clean wing produces a strong, concentrated vortex. As the flaps are lowered, the vortex system becomes more diffuse. Pilot opinion and roll acceleration data indicate that 4.5 nautical miles would be a minimum separation distance at which roll control could be maintained during parallel encounters of the B727's landing configuration wake by small aircraft. Author

**N76-14047*#** Boeing Commercial Airplane Co., Seattle, Wash. Loads Research Group.
**REQUIREMENTS FOR IMPLEMENTATION OF KUESSNER AND WAGNER INDICIAL LIFT GROWTH FUNCTIONS INTO THE FLEXSTAB COMPUTER PROGRAM SYSTEM FOR USE IN DYNAMIC LOADS ANALYSES Final Report, Jun. 1973 - Sep. 1975**
Ronald D. Miller and John T. Rogers Sep. 1975 36 p refs
(Contract NAS2-7729)

(NASA-CR-137718) Avail: NTIS HC $4.00 CSCL 01A

General requirements for dynamic loads analyses are described. The indicial lift growth function unsteady subsonic aerodynamic representation is reviewed, and the FLEXSTAB CPS is evaluated with respect to these general requirements. The effects of residual flexibility techniques on dynamic loads analyses are also evaluated using a simple dynamic model. Author

**N76-14048*#** Boeing Commercial Airplane Co., Seattle, Wash.
**SOLUTIONS TO KUESSNER'S INTEGRAL EQUATION IN UNSTEADY FLOW USING LOCAL BASIS FUNCTIONS Final Report**
J. A. Fromme and D. W. Halstead Sep. 1975 68 p refs
(Contract NAS2-7729)
(NASA-CR-137719; D6-43599) Avail: NTIS HC $4.50 CSCL 01A

The computational procedure and numerical results are presented for a new method to solve Kuessner's integral equation in the case of subsonic compressible flow about harmonically oscillating planar surfaces with controls. Kuessner's equation is a linear transformation from pressure to normalwash. The unknown pressure is expanded in terms of prescribed basis functions and the unknown basis function coefficients are determined in the usual manner by satisfying the given normalwash distribution either collocationally or in the complex least squares sense. The present method of solution differs from previous ones in that the basis functions are defined in a continuous fashion over a relatively small portion of the aerodynamic surface and are zero elsewhere. This method, termed the local basis function method, combines the smoothness and accuracy of distribution methods with the simplicity and versatility of panel methods. Predictions by the local basis function method for unsteady flow are shown to be in excellent agreement with other methods. Also, potential improvements to the present method and extensions to more general classes of solutions are discussed. Author

**N76-14049*#** Transemantics, Inc., Washington, D.C.
**SKIN FRICTION IN A TURBULENT BOUNDARY LAYER WITH A POSITIVE PRESSURE GRADIENT**
O. N. Kashinskiy, S. S. Kutateladze, V. A. Mukhin, and V. Ye. Nakoryakov Washington NASA Dec. 1975 12 p refs Transl. into ENGLISH from Zh. Prikl. Mekh. Tekh. Fiz. (USSR), no. 6, Nov. - Dec. 1974 p 92-96
(Contract NASw-2792)
(NASA-TT-F-16695) Avail: NTIS HC $3.50 CSCL 01A

Conventional methods for determining skin friction in a turbulent boundary layer on a plate are insufficiently accurate in the case of flows with pressure gradients. It is shown that accurate skin friction data can be obtained by an electrochemical technique. The shear stress intensity fluctuations at the wall and the appearance of backflows are studied. Author

**N76-14050*#** Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
**A STUDY OF GUST AND CONTROL RESPONSE OF MODEL ROTOR-PROPELLERS IN A WIND TUNNEL AIRSTREAM**
Norman D. Ham, Paul H. Bauer, Thomas H. Lawrence, and Masahiro Yasue Aug. 1975 55 p refs
(NASA-CR-137756; ASRL-TR-174-4) Avail: NTIS HC $4.50 CSCL 01A

One-ninth-scale model hingeless and gimballed rotor-propellers were tested at an advance ratio of 0.7 in the Wright Brothers Wind Tunnel at MIT, in the presence of sinusoidal longitudinal and vertical gusts produced by a gust generator of novel design. The gimballed rotor was also subjected to sinusoidal collective and cyclic control inputs. Model test data in terms of blade inplane and out-of-plane bending, longitudinal and lateral gimbal motion, wing vertical and chordwise bending, and blade and wing torsion are presented and compared with theory. Author

**N76-14051#** Rochester Applied Science Associates, Inc., N.Y.
**HIGH LIFT GENERATION BY THE USE OF VORTICES Final Technical Report, Jan. - Dec. 1974**
Richard P. White, Jr. and Andrew D. Zalay Jul. 1975 97 p refs
(Contract N00014-74-C-0091; NR Proj. 212-223)
(AD-A014088; RASA/SRL-74-12) Avail: NTIS CSCL 20/4

A theoretical research program was conducted to investigate the feasibility of improving the aerodynamic lift and drag characteristics of a highly loaded lifting surface by creating a favorable wing vortex interaction with concentrated line vortices located adjacent to the wing. Beneficial wing vortex interactions are found to be responsible for improved aerodynamic performance of high lift devices such as strakes, canards, and leading edge snags. A simplified analytic model has been developed. GRA

**N76-14052#** Boston Univ., Mass. Engineering Labs.
**AN EXPERIMENTAL STUDY OF AERODYNAMIC CHARACTERISTICS OF LONGITUDINALLY TRUNCATED CYLINDERS AND CONE-CYLINDERS**
Rocco Girolamo Jan. 1975 74 p refs
(Contract F19628-71-C-0209)
(AD-A014087; AFCRL-TR-75-0107; SR-4) Avail: NTIS CSCL 19/7

An investigation has been conducted at the Boston University supersonic wind-tunnel testing facility to determine the aerodynamic characteristics of the payload sections of sounding rockets designed to increase drag during re-entry. The higher drag is desired in order to increase the vehicle's atmospheric braking during re-entry so that its velocity is reduced to M-2 at a much higher altitude than is ordinarily attained. This would allow earlier parachute deployment, thus increasing airborne time and facilitating mid-air recovery by aircraft. GRA

**N76-14053#** ARO, Inc., Arnold Air Force Station, Tenn.
**EXPERIMENTAL MAGNUS AND STATIC STABILITY CHARACTERISTICS OF BALLISTIC PROJECTILES WITH VARIOUS BOATTAIL ANGLES AND LENGTHS AT MACH NUMBERS FROM 0.5 THROUGH 2.5 Final Report**
Leroy M. Jenke and T. O. Shadow AEDC Aug. 1975 130 p refs
(AF Proj. 2547)
(AD-A013795; ARO-PWT-TR-75-12; AEDC-TR-75-40; AFATL-TR-75-52) Avail: NTIS CSCL 19/1

An experimental investigation was conducted to determine the effect of boattail angle, boattail length, and base diameter on the Magnus-force and moment characteristics of spin-stabilized projectiles. The models were tested at Mach numbers from 0.5 through 1.3 over an angle-of-attack range from -2 to 8 deg. Data were obtained for a range of Reynolds numbers and for several spin parameter values. Results of this test, as well as results for Mach numbers 1.5, 2.0, and 2.5 from previous tests, are presented showing the effects of Mach number, angle of attack, spin rate, and boattail geometry. GRA

**N76-14054#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**MOTIONS OF A PAYLOAD ON A TETHERED, AERODYNAMIC-SHAPE BALLOON USING VARIOUS CABLE LENGTHS Instrumentation Papers**
Don E. Jackson and Catherine B. Rice 17 Mar. 1975 60 p refs
(AF Proj. 6665)
(AD-A013788; AFCRL-IP-229; AFCRL-TR-75-0148) Avail: NTIS CSCL 01/3

A series of flight tests of a classic British barrage (kite) balloon was made at White Sands Missile Range in a variety of wind conditions and tether lengths. The report presents the motions of a payload suspended beneath the balloon as measured by ground-based cinetheodolites and balloon-borne sensors. Included in the data are horizontal and vertical trajectories, maximum displacement, pitch and roll angles, ground speed, and acceleration. GRA

**N76-14055#** Army Foreign Science and Technology Center, Charlottesville, Va.
**CALCULATION OF THE AERODYNAMIC LOADING ON THE BLADE OF A MAIN ROTOR IN THE GENERAL CASE OF HELICOPTER FLIGHT**
A. N. Bazilevskii, I. G. Pavlov, and A. K. Yanko 30 Apr. 1975 21 p refs Transl. into ENGLISH from the book "Voprosy Aerodinamiki i Electrogidrodinamiki Sbornik Nauchnykh Trudov" USSR, no. 6, 1970 p 179-188
(AD-A014047; FSTC-HT-23-0431-75) Avail: NTIS CSCL 01/1

Expressions for calculating the aerodynamic loading on a helicopter rotor blade are derived for the general case of helicopter flight along some curvilinear trajectory. A one-rotor helicopter scheme is examined. Rotor blade-fuselage interaction is not considered. GRA

**N76-14021** Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
**FLOW FIELD ASPECT OF TRANSONIC PHENOMENA**
B. Monnerie *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 15-20 (For availability see N76-14018 05-01)

**N76-14025** Advisory Group for Aerospace Research and Development, Paris (France).
**BUFFET DEFINITION AND CRITERIA**
*In its* The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 63-83 (For availability see N76-14018 05-01)

**N76-14026** Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
**BUFFET ANALYSIS**
P. J. Butkewicz *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 84-90 (For availability see N76-14018 05-01)

**N76-14304*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**AERODYNAMIC STATIC DIFFERENTIAL PRESSURE VALUES FOR THE 50 PERCENT POROUS REFLECTOR DISH**
M. S. Katow *In its* The Deep Space Network 15 Oct. 1975 p 60-65 refs (For availability see N76-14296 05-31)
CSCL 01A

# 03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

**N76-14056*#** Virginia Univ., Charlottesville. School of Engineering and Applied Science.
**OPTIMIZATION OF MLS RECEIVERS FOR MULTIPATH ENVIRONMENTS Interim Report**
G. A. McAlpine, J. H. Highfill, III, S. H. Irwin, and J. E. Padgett Dec. 1975 165 p refs
(Grant NsG-1128)
(NASA-CR-145906; EE-4033-101-75) Avail: NTIS HC $6.75 CSCL 01E

A receiver is designed for aircraft (A/C), which, as a component of the proposed Microwave Landing System (MLS), is capable of optimal performance in the multipath environments found in air terminal areas. Topics discussed include: the angle-tracking problem of the MLS receiver; signal modeling; preliminary approaches to optimal design; suboptimal design; and simulation study. Author

**N76-14057*#** California Univ., Berkeley. Inst. of Transportation and Traffic Engineering.
**AN ANALYSIS OF SHORT HAUL AIRLINE OPERATING COSTS**
Adib Kanafani and Seyfollah Taghavi Oct. 1975 101 p refs (Contract NAS2-7879)
(NASA-CR-137763) Avail: NTIS HC $5.50 CSCL 05C

The demand and supply characteristics of short haul air transportation systems are investigated in terms of airline operating costs. Direct, indirect, and ground handling costs are included. Supply models of short haul air transportation systems are constructed. J.M.S.

**N76-14058*#** California Univ., Berkeley. Inst. of Transportation and Traffic Engineering.
**STUDIES IN THE DEMAND FOR SHORT HAUL AIR TRANSPORTATION**
Adib Kanafani, Geoffrey Gosling, and Seyfollah Taghavi Oct. 1975 63 p refs
(Contract NAS2-7879)
(NASA-CR-137764) Avail: NTIS HC $4.50 CSCL 05C

Demand is analyzed in a short haul air transportation corridor. Emphasis is placed on traveler selection from available routes. Model formulations, estimation techniques, and traffic data handling are included. J.M.S.

**N76-14059#** Advisory Group for Aerospace Research and Development, Paris (France).
**AIRCRAFT FIRE SAFETY**
Oct. 1975 330 p Partly in ENGLISH, partly in FRENCH Presented at the 45th Meeting of the AGARD Propulsion and Energetics Panel, Rome, 7-11 Apr. 1975
(AGARD-CP-166) Avail: NTIS HC $10.00

Fire, toxic, and explosion hazards associated with aircraft accidents and fires are reviewed. Specific areas discussed include: prevention techniques; the impact of changes in fuel specifications on aircraft fire safety; and evaluation of test techniques for flame propagation and extinguishment. Actual aircraft accidents are also reviewed and analyzed. For individual titles, see N76-14060 through N76-14087.

**N76-14060** Royal Aircraft Establishment, Farnborough (England). Materials Dept.
**SAFETY FUEL RESEARCH IN THE UNITED KINGDOM**
R. E. Miller *In* AGARD Aircraft Fire Safety Oct. 1975 10 p refs (For availability see N76-14059 05-03)

Aircraft fuels which resist fire in a crash are investigated. Emphasis is placed on polymeric additives which prevent fuel mist condition. At 0.3% concentration these additives prevent kerosene fires under realistic crash conditions with both flame and heated duct ignition sources. High internal phase ratio emulsions gave no fire resistance in these tests. Methods of introducing the additive and the possible extent of water compatibility and filtration problems are discussed. Author

**N76-14061** Southwest Research Inst., San Antonio, Tex. US Army Fuels and Lubricants Research Lab.
**STATUS OF RESEARCH ON ANTIMIST AIRCRAFT TURBINE ENGINE FUELS IN THE UNITED STATES**
W. D. Weatherford, Jr. and B. R. Wright *In* AGARD Aircraft Fire Safety Oct. 1975 12 p refs (For availability see N76-14059 05-03)

The physical, compatibility, and fire safety characteristics of fuel blends containing polymeric antimist agents are discussed in terms of reducing the frequency of in-flight and post-crash aircraft fires. The experimental bench and larger scale evaluation procedures used and the experimental results obtained with several polymeric antimist additives are described. Both fire safety and systems compatibility characteristics and problems are included. Projections are made regarding the future direction of research on such antimist aircraft turbine fuels. Author

**N76-14062** National Research Council of Canada, Ottawa (Ontario). Fuels and Lubricants Lab.
**WIDE-CUT VERSUS KEROSENE FUELS: FIRE SAFETY AND OTHER OPERATIONAL ASPECTS**
R. B. Whyte and L. Gardner *In* AGARD Aircraft Fire Safety Oct. 1975 20 p refs (For availability see N76-14059 05-03)

The relationships between fuel properties and safety and aircraft operation are summarized. The specifications are compared for wide-cut and kerosene type fuels with emphasis on the properties which can affect operation and safety. The difference in volatility and effects on ignition, combustion, and explosion are discussed as well as other properties (fluidity, cleanliness, and vapor release) which can affect aircraft operations. Ground operations (handling, maintenance and engine starting) and flight operations (fire hazard, engine relight, fuel system icing and freezing, range and payload) are considered. It is concluded that, provided all necessary precautions are diligently enforced the risks involved in using wide-range fuel are at worst only marginally greater than with kerosene. Author

**N76-14063** Royal Aircraft Establishment, Farnborough (England).
**SYSTEMS PROBLEMS ASSOCIATED WITH THE USE OF SAFETY FUELS**
R. H. Walsh, E. A. Timby, and D. J. R. Robinson *In* AGARD Aircraft Fire Safety Oct. 1975 12 p (For availability see N76-14059 05-03)

The performance of components in aircraft fuel systems is investigated when using crash-fire-resistant antimisting aircraft fuels. The effect that the systems have on the fuels is also considered. It is found that the use of safety fuels could result in a continual degradation of their crash-fire-resistant properties. The degradation in the major components of the system is measured and the results are used to program a computer study to predict the state of the fuel remaining in the aircraft on landing following a full range flight. Author

**N76-14064** Societe Nationale Industrielle Aerospatiale, Toulouse (France).
**IGNITION PROOFING OF FUEL TANKS [INERTAGE DES RESERVOIRS DE CARBURANT]**
Georges Frechou *In* AGARD Aircraft Fire Safety Oct. 1975 7 p In FRENCH (For availability see N76-14059 05-03)

The following topics were discussed: (1) causes of fires and flammability of fuels, (2) precautions taken to reduce the risks and the resulting problems for the aircraft designers in view of the ever more stringent competitive requirements within the aviation industry, (3) the advantage of ignition proofing fuel tanks. It is shown that an effective way to ignition proof fuel tanks is to reduce the percentage of oxygen in the gaseous mixture above the fuel, since this mixture will not be explosive if the oxygen percentage is below 9 or 10%. This however requires that the fuel tanks be pressurized to prevent outside air from entering and, furthermore, that the gases dissolved in the fuel should contain less than 10% oxygen. It was concluded that the resulting design and operational problems do not outweight the expected benefits. Y.J.A.

**N76-14065** Societe Intertechnique, Plaisir (France).
**IGNITION PROOFING OF FUEL TANKS WITH OXYGEN-DEFICIENT AIR OBTAINED BY DIFFUSION THROUGH A SEMI-PERMEABLE MEMBRANE [INERTAGE DES RESERVOIRS DE CARBURANT AVEC DE L'AIR APPAUVRI EN OXYGENE PAR PERMEATION]**
Jean Tugaye *In* AGARD Aircraft Fire Safety Oct. 1975 5 p In FRENCH (For availability see N76-14059 05-03)

The possibility of using oxygen-deficient air in the ignition proofing of fuel tanks was successfully tested in the laboratory. The oxygen-deficient air is obtained by diffusing air under pressure through a special synthetic semi-permeable membrane 0.2 micron thick, supported by a porous plate of the same material 0.2 mm thick. Depending on the temperature, oxygen will diffuse two or three times more rapidly through such a system than nitrogen. High pressure air contained within such a system will therefore become oxygen-deficient. A practical airworthy system utilizing this concept inside fuel tanks must include the following systems: heat exchangers, auxiliary air compressor, and fuel deoxygenating device. The proposed system would be primarily advantageous on aircraft undergoing a large number of landings and takeoffs between refuellings, since it would then be lighter and less bulky than a system using liquid nitrogen. Y.J.A.

**N76-14066** National Research Council of Canada, Ottawa (Ontario). Fuels and Lubricants Lab.
**FLAME PROPAGATION IN AIRCRAFT VENT SYSTEMS DURING REFUELLING**
L. Gardner and J. K. S. Wong *In* AGARD Aircraft Fire Safety Oct. 1975 9 p refs (For availability see N76-14059 05-03)

An investigation was made to determine if ignition at the fuel system vent box of a large commercial aircraft during refuelling could result in flame propagation through the vent system and cause an explosion inside one of the fuel tanks. The program was initiated as the result of an explosion during a commercial refuelling and was confined to investigating the type of series of aircraft involved utilizing a simulation of part of the vent system leading to the tank where the explosion originated. The ability of the flame to propagate was demonstrated using wide-cut fuel and a 50/50 mixture of wide-cut fuel and kerosene. No propagation occurred with kerosene nor with wide-cut fuel that had lost 5% of its light ends. Flame propagation and explosion intensity were found to depend on mixture temperature, fuel/air ratio, mixture flow velocity, and oxygen content of the air. Author

**N76-14067** Falcon Research and Development Co., Denver, Colo.
**DYNAMIC MODELING OF AIRCRAFT FUEL TANK ENVIRONMENTS AND VULNERABILITY**
Levelle Mahood *In* AGARD Aircraft Fire Safety Oct. 1975 9 p refs (For availability see N76-14059 05-03)

The environments, hazards, and vulnerability of regions adjacent to and within aircraft fuel tanks are discussed along with the importance and difficulties of developing fuel tank environment models to assess aircraft combat vulnerability and operating safety. Various approaches to modeling the flammability of the ullage of an aircraft fuel tank are described. Examples are given to illustrate various ways that dynamic effects radically alter equilibrium vapor conditions in the ullage. The method of applying the fuel tank ullage environment model to computerized aircraft vulnerability programs is described. Author

**N76-14068** Societe Nationale Industrielle Aerospatiale, Suresnes (France).
**CABIN FINISHING MATERIALS IN CIVIL PASSENGER AIRCRAFT [LES MATERIAUX D'INTERIEUR CABINE DANS LES AVIONS DE TRANSPORT CIVILS]**
Andre Blavy *In* AGARD Aircraft Fire Safety Oct. 1975 3 p In FRENCH (For availability see N76-14059 05-03)

A review of the various types of cabin finishing materials used inside civil passenger aircraft and their properties was presented, with special focus on their flammability and generation of toxic fumes when set fire. The following facts were summarized: (1) materials from which fires may be easily extinguished generally emit more smoke, (2) fire-proof materials often emit toxic fumes, (3) combustion of these materials, due to their self-extinguishing properties, result in oxygen depletion and carbon monoxide formation, the primary cause of intoxication. The primary emphasis should be placed on rapid extinguishing of any incipient fire. Y.J.A.

**N76-14069*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**FIRE DYNAMICS OF MODERN AIRCRAFT FROM A MATERIALS POINT OF VIEW**
John A. Parker, Demetrius A. Kourtides, Richard H. Fish, and William J. Gilwee, Jr. *In* AGARD Aircraft Fire Safety Oct. 1975 11 p refs (For availability see N76-14059 05-03)

A general approach for selecting polymers to increase fire safety in aircraft is described. It is shown that polymer flammability and thermal protection capability are related to the molecular structure of the polymer and its thermochemical properties. These criteria are used to develop advanced fire-resistant materials which can achieve increased survivability in both post-crash and in-flight fires. The degree of fire hardening of materials depends greatly on the available heat load and fire threat present. It is shown that improvements in fire safety can be achieved by the use of polymers possessing certain basic thermochemical parameters such as high char yield. Author

**N76-14070** Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Jr. Engineer Materials and Processes Group.
**CRITICAL EVALUATION OF TODAYS FIREPROOF TESTING OF AEROSPACE MATERIALS**
L. M. Godfried *In* AGARD Aircraft Fire Safety Oct. 1975 10 p (For availability see N76-14059 05-03)

The usefulness of the requirements and methods of tests for the judgement of materials or materials combinations in aerospace vehicle application is discussed. It is shown that the application, test requirements, and test methods criteria for materials sometimes provide questionnable fire safety. Author

**N76-14071** Commissariat a l'Energie Atomique, Toulouse (France).
**MEASUREMENT AND ANALYSIS OF SMOKE AND TOXIC GASES RESULTING FROM THE COMBUSTION OF AIRCRAFT CABIN FINISHING MATERIALS [MESURE DES FUMEES ET ANALYSE DES GAZ TOXIQUES PROVOQUES**

**PAR LA COMBUSTION DES MATERIAUX D'AMENAGEMENT DE CABINE D'AVION]**
J. Auvinet *In* AGARD Aircraft Fire Safety Oct. 1975 12 p In FRENCH (For availability see N76-14059 05-03)

The results of studies and research on the combustion of aircraft cabin finishing materials and the resulting smoke generation and production of toxic gases were reported. Results of tests measuring the concentration of the various gases resulting from the combustion of these materials were first presented, based on burning small samples under controlled conditions. Next, a near full-size mockup of a simulated aircraft cabin section, divided into passenger and freight sections by a horizontal floor, was constructed and instrumented for more realistic combustion tests. This mockup was equipped with ventilation, safety, fire extinguishing, heat protection, pressurization, lighting, and chemical analysis systems. Preliminary tests were undertaken with this mockup and were reported. Y.J.A.

**N76-14072** Royal Aircraft Establishment, Farnborough (England). Materials Dept.
**SOME ASPECTS OF SMOKE AND FUME EVOLUTION FROM OVERHEATED NON-METALLIC MATERIALS**
A. J. Christopher *In* AGARD Aircraft Fire Safety Oct. 1975 12 p refs (For availability see N76-14059 05-03)

A dynamic system for assessing the smoke and fume emission characteristics of nonmetallic materials is described. A sample of the material under examination is heated from ambient to 500 C in a stream of air. The behavior of the material under in-flight electrical overheating conditions is simulated. Sample temperature, smoke density, and electrode response in a water bubbler are monitored. Results obtained for various materials are presented and discussed. Author

**N76-14073** Utah Univ., Salt Lake City. Flammability Research Center.
**ANALYSIS OF THE PRODUCTS OF THERMAL DECOMPOSITION OF AN AROMATIC POLYAMIDE FABRIC USED AS AN AIRCRAFT INTERIOR MATERIAL**
I. N. Einhorn, D. A. Chatfield, and R. W. Mickelson *In* AGARD Aircraft Fire Safety Oct. 1975 13 p refs (For availability see N76-14059 05-03)

The thermochemistry of an aromatic polyamide fabric used in the interior of wide-bodied commercial jet aircraft was explored using several analytical techniques. The principal emphasis was to identify the products resulting from pyrolysis, oxidative degradation, and flaming combustion. The pyrolysis data was used to obtain a material balance between the elemental composition of the original polymer and the degradation products. Author

**N76-14074** Princeton Univ., N.J. Guggenheim Labs.
**FLAME SPREADING ACROSS MATERIALS: A REVIEW OF FUNDAMENTAL PROCESSES**
William A. Sirignano *In* AGARD Aircraft Fire Safety Oct. 1975 12 p refs (For availability see N76-14059 05-03)

A critical review of the existing researches on flame spread above solid combustible materials is given; both theory and experiment are considered. Special attention is given to the determination of the rate-controlling mechanism for energy transfer ahead of the flame and therefore to the determination of the flame spreading rate. The mechanism could be either gas-phase conduction, radiation, gas-phase convection, or some combination of these. Important factors discussed include: natural convective flows, orientation of the direction of flame spread with respect to gravity, thickness of the burning material, and the values of the conductivity, diffusivities, heats of reaction and pyrolysis, chemical kinetic constants, and ambient oxygen concentration. It is indicated how changes in these factors can produce changes in the rate-controlling mechanism. Author

**N76-14075** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
**ON THE APPLICABILITY OF RETICULATED FOAMS FOR THE SUPPRESSION OF FUEL TANK EXPLOSIONS**
R. Fiala, K. Dussa, and G. Winterfeld *In* AGARD Aircraft Fire Safety Oct. 1975 12 p refs (For availability see N76-14059 05-03)

The flame suppression properties of polyurethane foams with varying cell size were studied by means of a flame tube and an explosion vessel. Results on the thickness of the foam layer necessary for flame quenching are given: depending on pore size, fuel-air ratio, and on pressure. The behavior of reticulated foam during explosion in a closed vessel is discussed, as well as its mechanical behavior. Conclusions with respect to the application of foam structures in tanks are presented. Author

**N76-14076** Royal Aircraft Establishment, Farnborough (England). Engineering Physics Dept.
**FIRE PROTECTION OF FUEL SYSTEMS IN COMBAT AIRCRAFT**
J. A. MacDonald and H. W. G. Wyeth *In* AGARD Aircraft Fire Safety Oct. 1975 15 p ref (For availability see N76-14059 05-03)

The conditions which affect fire and explosion probability within aircraft fuel tanks and surrounding bays are examined. Particular attention is given to the effect of fuel type, target construction, and other environmental conditions. From a knowledge of the physical effects following projectile attack, systems are suggested which could significantly reduce the risk of fire and explosion. Author

**N76-14077** Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Fuels and Lubrication Div.
**AIRCRAFT FIRE PROTECTION TECHNOLOGY**
B. P. Botteri *In* AGARD Aircraft Fire Safety Oct. 1975 15 p refs (For availability see N76-14059 05-03)

Aircraft fire protection under natural and hostile (combat) flight environment conditions is discussed. Achievement of fire protection capability is dependent upon a knowledge of ignition, flammability, and reaction severity characteristics of the combustible materials present and use of this knowledge in the design of the aircraft. Specific areas discussed include: fire and explosion hazard assessment (including fire safe fuels), fire prevention design measures, advanced fire and overheat detection systems, void space and dry bay fire suppression techniques, and fuel tank fire and explosion protection systems. Author

**N76-14078** British Aircraft Corp., Warton (England).
**FIRE PROTECTION OF MILITARY AIRCRAFT**
John Vincent *In* AGARD Aircraft Fire Safety Oct. 1975 15 p (For availability see N76-14059 05-03)

The problems associated with 'classical' engine bay fire detection and suppression systems are examined along with airframe design constraints. The primary and secondary fire problem is considered. Statistical evidence from modern war shows that the highest proportion of aircraft kills is due to primary and secondary fire. The application of possible fire suppressant methods is discussed. The current structural and system design philosophy is questioned with respect to achieving improved fire protection of military aircraft. Author

**N76-14079** Pisa Univ. (Italy).
**THE USE OF ROCKETS AGAINST CRASH FIRES IN AIRPORT AREAS**
M. Andrenucci *In* AGARD Aircraft Fire Safety Oct. 1975 12 p refs (For availability see N76-14059 05-03)

The use of rockets is proposed as a means of fighting crash fires, due to their quickness, easy operation, and ability to reach sites not readily accessible by other means. Possible vehicle configurations are discussed along with system operating modes. Details are given of a simulation study, intended for providing the major specifications for the system components performance with respect to efficacy, reliability, and safety requirements. Cost factors are considered. Author

**N76-14080** Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
**FIRE FIGHTING AGENTS FOR LARGE AIRCRAFT FUEL FIRES**
R. Fiala and K. Dussa *In* AGARD Aircraft Fire Safety Oct. 1975 10 p refs (For availability see N76-14059 05-03)

For a critical evaluation of the properties of the different types of agents experiments were carried out using standardized small and large fuel fires (4 sq m and 200 sq m). The time until extinguishment occured and the amount of agent needed, were measured. Additionally, the time which, after a deliberate

reignition, elapsed until the whole fuel surface was on fire again, was measured. Results are discussed. Author

**N76-14081** Joint Fire Research Organization, Boreham Wood (England). Extinction Section.
**THE EXTINCTION OF AIRCRAFT CRASH FIRES**
P. Nash *In* AGARD Aircraft Fire Safety Oct. 1975 13 p refs (For availability see N76-14059 05-03)

The problems are discussed of the aircraft crash fire, including the difficulty of arrival of the fire-fighting services in time to save life. The different fire fighting agents available are appraised. Fire fighting foams are shown to be the only satisfactory primary fire fighting agents for major crash fire use. The research and development of foam liquids and the means used to assess their performance are discussed in terms of the physical properties of the foam liquid. The development of foam making equipment and appliances in order to put the foam liquid to best use to meet the operational requirement is examined. Author

**N76-14082** Federal Aviation Administration, Atlantic City, N.J.
**CHARACTERISTICS OF HALON 1301 DISPENSING SYSTEMS FOR AIRCRAFT CABIN FIRE PROTECTION**
Constantine P. Sarkos *In* AGARD Aircraft Fire Safety Oct. 1975 16 p refs (For availability see N76-14059 05-03)

A cabin fire protection system using Halon 1301, an extinguishing agent previously tested and shown to be effective in suppressing and controlling fires in a simulated transport cabin section and a cargo compartment is investigated. Tests were conducted in an obsolete but completely furnished DC-7 passenger cabin equipped with two candidate Halon 1301 dispensing systems: modular nozzle and perforated tube. Under no-fire conditions, continuous measurements were made of the Halon 1301 concentration at approximately 20 locations; measurements were also made of temperature, noise, pressure, and visibility. The modular nozzle system was judged to be best by virtue of its producing more rapid and effective agent distribution resulting in greater potential fire protection capability. Halon 1301 was found to rapidly permeate all cabin airspaces, including those shielded from the discharge streamlines. Author

**N76-14083** Karlsruhe Univ. (West Germany).
**A LABORATORY TEST METHOD OF EVALUATING THE EXTINGUISHING EFFICIENCY OF DRY POWDERS**
Paul G. Seeger *In* AGARD Aircraft Fire Safety Oct. 1975 9 p refs (For availability see N76-14059 05-03)

The laboratory test method of evaluating the estinguishing efficiency of dry powders is based on the burning velocity of a laminar premixed methane-air flame. The dry powder being tested is fed into the premixed fuel gas-air flow by a vibrating chute. The powder particles reach the test flame and reduce the burning velocity more or less depending on their extinguishing efficiency. The burning velocity is determined by the nozzle method and by schlieren photography. The evaluation of the measurements shows that the square of the burning velocity is a linear function of the mass flow of the dry powder fed into the fuel gas-air flow. The theoretical minimum value of the mass flow of the dry powder necessary to extinguish the test flame may be determined by the slope of the straight line. Author

**N76-14084** Pinkel (I. Irving), Fairview Park, Ohio.
**DYNAMIC EFFECTS IN THE SETTING OF AIRPLANE CRASH FIRES**
I. Irving Pinkel *In* AGARD Aircraft Fire Safety Oct. 1975 4 p (For availability see N76-14059 05-03)

The principal features of airplane crash dynamics are described. Factors considered include: fuel spillage; movement of spilled fuel to main ignition sources; propagation modes of fire to the main spillage and the fuel tank opening. Some of the main factors in the ignition and spread of fire are illustrated with slow motion pictures of full-scale airplane crashes. Author

**N76-14085** Cranfield Inst. of Technology (England).
**FIRE, FUEL AND SURVIVAL: A STUDY OF TRANSPORT AIRCRAFT ACCIDENTS, 1955 - 1974**
A. F. Taylor *In* AGARD Aircraft Fire Safety Oct. 1975 14 p refs (For availability see N76-14059 05-03)

Accident summaries and reports are examined together with existing papers on the various aspects of fire safety, the aim being to piece together a complete picture of the part fire has had in determining overall fatality rates in transport aircraft accidents. Note is taken of the sensitivity of the fire death ratio to the number of high impact accidents with no chance of survival and of how this sensitivity may have clouded some past comparisons between fuels of different volatility. It is indicated that in post impact fires the higher volatility fuels, gasoline and wide-cut gasoline, have been responsible for proportionately more fire deaths than has low volatility kerosine, thus confirming predictions based on theory and experiment. Author

**N76-14086** Swissair, Zurich (Switzerland).
**PASSENGER AIRCRAFT CABIN FIRES**
Willi Schurter *In* AGARD Aircraft Fire Safety Oct. 1975 5 p (For availability see N76-14059 05-03)

After a brief review of the established findings on the crash of a Swissair Coronado CV-990A in Wurenlingen, Switzerland, on February 21, 1970, an analysis of the cabin fire preceding the crash is given, including origin of fire, its propagation and effects on the aircraft systems. A method of establishment of elevated local temperatures in cargo compartment and cabin by means of uncommon fractures as found in the wreckage is described. The role played by the major aircraft systems is discussed. Furthermore, since the smoke spreading in cabin and cockpit is considered the factor rendering the aircraft uncontrollable under the prevailing conditions, the results of tests carried out simulating the smoke conditions are given. Author

**N76-14087** Secretariat General a l'Aviation Civile, Paris (France).
**CRASH OF THE PP-VJZ AIRCRAFT [L'ACCIDENT DU PP-VJZ]**
P. Guillevic *In* AGARD Aircraft Fire Safety Oct. 1975 6 p In FRENCH (For availability see N76-14059 05-03)

The results of investigations that followed the crashes of two aircraft (a Caravelle in 1968 and a Boeing 707 in 1973) following fires that started in rear washrooms were reported. In both cases, it was concluded that fatalities were primarily caused by intoxication resulting from the inhalation of carbon monoxide and highly acidic toxic vapors such as chlorhydric acid and cyanhydric acid originating in the combustion of cabin finishing materials. Y.J.A.

**N76-14088*#** Honeywell, Inc., Minneapolis, Minn.
**ANALYTICAL EVALUATION OF ILM SENSORS Final Report**
Raymond J. Kirk, C. Edward Johnson, and Douglas Doty Oct. 1975 187 p refs
(Contract NAS1-13489)
(NASA-CR-144902; F-2132-Suppl) Avail: NTIS HC $7.50 CSCL 01E

Functional requirements and operating environment constraints for an Independent Landing Monitor for aircraft landings in Cat. 2/3 weather conditions are identified and translated into specific sensing requirements. State-of-the-art capabilities of radar, TV, FLIR, multilateration, microwave radiometry, interferometry, redundant MLS and nuclear sensing concepts are evaluated and compared to the requirements. Concepts showing the best ILM potential are identified elsewhere in this series. Three specific concepts are identified: bistatic radar, complex interferometry, and circular synthetic aperture. Author

**N76-14089*#** Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
**GENERAL AVIATION TECHNOLOGY ASSESSMENT**
Ira D. Jacobson Oct. 1975 52 p refs
(Grant NGR-47-005-202)
(NASA-CR-145979; ESS-4039-103-75; TR-403905) Avail: NTIS HC $4.50 CSCL 01B

The existing problem areas in general aviation were investigated in order to identify those which can benefit from technological payoffs. The emphasis was placed on acceptance by the pilot/passenger in areas such as performance, safety, handling qualities, ride quality, etc. Inputs were obtained from three sectors: industry; government; and user, although slanted toward the user group. The results should only be considered preliminary due to the small sample sizes of the data. Trends are evident however and a general methodology for allocating effort in future programs is proposed. Author

**N76-14090#** Federal Aviation Administration, Washington, D.C.
**AIRLINE DELAY TRENDS, 1972-1973. STUDY OF BLOCK TIME DELAYS GROUND AND AIRBORNE FOR SCHEDULED AIR CARRIERS. VOLUME 1: SUMMARY Final Report**
Seymour M. Horowitz Jun. 1975 137 p
(AD-A015870/9; FAA-EM-74-11-Vol-1) Avail: NTIS HC $5.75 CSCL 01/2

Estimates of block time delays for the nation's domestic scheduled air carriers operating out of 20 major airports were determined from a data base recently made available by the CAB. This data base provides monthly averages of operational times, both airborne and on the ground, for all route segments receiving scheduled air carrier service, but these data are limited to the 325 route segments connecting with the 20 airports included in this study. Block time delays are those encountered from ramp to ramp on a route segment. Average monthly estimates of the delays for the airborne portion of the segment are provided for a two year period from 1972 to 1973, and are categorized according to (1) route segment, (2) airline, (3) aircraft type, and (4) local scheduled arrival or departure time. Average monthly estimates of the ground portion of the route segment are categorized according to arrival and departure ground times at the 20 specific airport locations connecting the network of routes included in the study. Estimates of arrival and departure ground delays at specific airports are categorized further into Busy and Dull time intervals. Author

**N76-14091#** Naval Air Development Center, Warminster, Pa. Crew Systems Dept.
**PROTOTYPE FABRICATION AND TESTING OF A MODIFIED MA-2 HARNESS Final Report**
M. J. Pavlick, M. Schwartz, and J. ORourke 30 Apr. 1975 58 p
(AD-A013640; NADC-75034-40) Avail: NTIS CSCL 01/2

There has been concern by the U.S. Navy over the fact that many pilots have received fatal injuries in what are termed as 'Survivable Crashes'. The problem appears to stem from the excessive amount of dynamic overshoot and rebound associated with existing pilot restraint systems. Dynamic analysis of restraint systems in crash situations has shown that a rigid restraint system is desired if 'dynamic overshoot' is to be eliminated. In a previous study, a rigid restraint system was designed and subjected to a series of dynamic tests. Results of the test showed an improvement in crew member survivability with a rigid restraint system but improvement was needed. In the present program low elongation harness materials were obtained and incorporated into the MA-2 integral restraint and parachute harness. The test results are discussed. GRA

**N76-14092#** National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
**AIRCRAFT ACCIDENT REPORTS: BRIEF FORMAT US CIVIL AVIATION, ISSUE NUMBER 5, 1974 ACCIDENTS. FILE NUMBER: 1-0008, 1-0030, 1-0036, 1-0039 THROUGH 1-0045, 3-3601 THROUGH 3-4106, 3-4108 THROUGH 3-4300**
16 May 1975 422 p
(PB-243421/5; NTSB-BA-75-2) Avail: NTIS HC $11.00 CSCL 01B

Selected aircraft accident reports are presented. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. GRA

**N76-14093#** National Transportation Safety Board, Washington, D.C.
**AIRCRAFT ACCIDENT REPORT FEDERAL AVIATION ADMINISTRATION DOUGLAS DC-3C, N6 DUBOIS, PENNSYLVANIA 27 MARCH 1975**
25 Jun. 1975 24 p
(PB-244224/2; NTSB-AAR-75-11; File-3-0288) Avail: NTIS HC $3.50 CSCL 01B

About 1435 e.d.t., March 27, 1975, a Federal Aviation Administration Douglas DC-3 crashed during takeoff on the DuBois-Jefferson County Airport, DuBois, Pennsylvania. The three cockpit occupants and one passenger were seriously injured. The other seven cabin occupants sustained minor injuries. The aircraft was destroyed. The pilot, inexperienced and unqualified in the DC-3, was making the takeoff with a 7-knot crosswind and with an unlocked tailwheel. The National Transportation Safety Board determines that the probable cause of the accident was loss of control at takeoff because of the inexperience of the unqualified pilot making the takeoff and because of the failure of the experienced pilot in the right seat to assume timely control. GRA

**N76-14094#** National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
**AIRCRAFT ACCIDENT REPORT USAF CONVAIR VT-29D (CV-340) AND CESSNA 150H, N50430 NEWPORT NEWS, VIRGINIA 9 JANUARY 1975**
18 Jun. 1975 31 p
(PB-244223/4; NTSB-AAR-75-10; File-3-0001) Avail: NTIS HC $4.00 CSCL 01B

About 1836 e.s.t., on January 9, 1974, a United States Air Force Convair VT-29D (CV-340) and a Cessna 150H collided in flight over the James River near Newport News, Virginia, at an altitude of 1,500 feet. The five crewmembers and two passengers aboard the Cessna were killed. Both aircraft were destroyed by the collision and subsequent impact with the water. The Convair was executing a precision radar approach to Langley Air Force Base and was under the control of the Langley Ground Control Approach final controller. The Cessna was on a local pleasure flight; it was operating in accordance with visual flight rules, and was not on a flight plan. The National Transportation Safety Board determines that the probable cause of this accident was the human limitation inherent in the see-and-avoid concept, which can be critical in a terminal area with a combination of controlled and uncontrolled traffic. GRA

**N76-14095#** Dunlap and Associates, Inc., Inglewood, Calif.
**THE EFFECT OF LIGHTED DECK SHAPE ON NIGHT CARRIER LANDING Final Report**
Joseph W. Wulfeck and John E. Queen Jun. 1975 56 p refs
(Contract N00014-72-C-0041; NR Proj. 196-115)
(AD-A014057) Avail: NTIS CSCL 01/2

The primary purpose of the experimental program reported was to explore the possibility of identifying a tunnel lighted deck shape which would minimize errors in judging it to be horizontal. The secondary purpose was to compare errors in judgment of the horizontal between direct viewing and TV viewing. Preliminary, main and 'check' experiments were conducted to establish the relation between generated glideslope (error in judging simulated lighted carrier deck shapes to be horizontal) and lighted deck shape. GRA

**N76-14031** Advisory Group for Aerospace Research and Development, Paris (France).
**CONCLUSIONS AND RECOMMENDATIONS**
*In its* The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 111-112 (For availability see N76-14018 05-01)

**N76-14033** Advisory Group for Aerospace Research and Development, Paris (France).
**APPROACH AND LANDING SIMULATION, INTRODUCTION**
*In its* Approach and Landing Simulation Oct. 1975 p 1-3 refs (For availability see N76-14032 05-01)

**N76-14034** Advisory Group for Aerospace Research and Development, Paris (France).
**ELEMENTS OF APPROACH AND LANDING SIMULATION**
*In its* Approach and Landing Simulation Oct. 1975 p 3-4 (For availability see N76-14032 05-01)

**N76-14035** Advisory Group for Aerospace Research and Development, Paris (France).
**EXTERNAL DISTURBANCES**
*In its* Approach and Landing Simulation Oct. 1975 p 4-14 (For availability see N76-14032 05-01)

**N76-14039** Advisory Group for Aerospace Research and Development, Paris (France).
**CONCLUDING REMARKS**

*In its* Approach and Landing Simulation Oct. 1975 p 28-61 refs (For availability see N76-14032 05-01)

# 04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

**N76-14096** George Washington Univ., Washington, D.C.
**AN IMPROVED PROCEDURE FOR REALIGNMENT OF INERTIAL PLATFORMS Ph.D. Thesis**
Arthur Frank Manfredi, Jr. 1975 196 p
Avail: Univ. Microfilms Order No. 75-22651

The problem of realigning an accurately aligned inertial platform from one azimuth to another is investigated. A linear system error model for the inertial platform is used. Orthogonal triads of accelerometers and gyros are assumed. The error equations are based on gyrocompassing. Accelerometer and gyro errors are included in the development. The error model equations are cast in the state-space notation and then the state equations are discretized. A general solution to the linear, stochastic, discrete-time control problem is applied to the platform realignment problem. A computer program which implements the solution is presented. Seven example problems are solved, using a Monte Carlo approach, to demonstrate the validity of the solution. Dissert. Abstr.

**N76-14097#** Logicon, Inc., San Pedro, Calif.
**ENROUTE AIR TRAFFIC CONTROL PROGRAM SOFTWARE OPTIMIZATION STUDY Final Report**
W. P. Kandler, W. C. Nielsen, R. C. Wick, and L. D. Prince Jun. 1975 222 p
(Contract DOT-FA74WA-3457)
(AD-A015172/0; CSS-75007A; FAA-RD-75-87) Avail: NTIS HC $7.50 CSCL 17/7

Results are reported of a 10-month study aimed at reducing the core storage and CPU utilization required by the NAS Enroute ATC operational software. Results are presented for six major categories: (1) monitor improvements, (2) program architecture improvements, (3) compool improvements, (4) mathematical improvement, (5) code optimization, and (6) micro-code utilization. Areas of significant inefficiency are identified for each category along with recommendations for improved designs, and the projected savings that would accrue from their implementation. The projected savings were confirmed by demonstrating two of the recommended improvement techniques at the NAFEC test bed facility in Atlantic City. A work plan is provided giving detailed task descriptions and schedule and manpower estimates for 21 areas for which implementation of alternate designs or additional analysis is recommended. Author

**N76-14098#** Stanford Research Inst., Menlo Park, Calif.
**CAPACITY AND PRODUCTIVITY IMPLICATIONS OF ENROUTE AIR TRAFFIC CONTROL AUTOMATION Final Report**
G. J. Couluris, R. S. Ratner, S. J. Petracek, P. J. Wong, and J. M. Ketchel Dec. 1974 155 p refs
(Contract DOT-FA70WA-2142)
(AD-A016622/3; SRI-8181; FAA-RD-74-196) Avail: NTIS HC $6.25 CSCL 17/7

Work performed to evaluate controller productivity and capacity benefits potentially realizable from postulated evolution of enroute air traffic control (ATC) automation is reported. This work focused on the workload limitations of human controllers and the effects on controllers of various automation applications to National Airspace System (NAS) Stage A3d.2 ATC. Empirical measurements of routine, surveillance, and conflict processing activities were used to develop workload models of control-team operations. These models are extensions of the relative capacity estimating process (RECEP) previously developed. They were used to assess the potential benefits of enhancements including an electronic tabular flight data display. The workload models were incorporated into the air traffic flow (ATF) network simulation model to assess the potential benefits of a computerized facility-level traffic flow control method termed planning control. Author

**N76-14099#** Federal Aviation Administration, Washington, D.C.
**RADAR ENHANCEMENT OF SMALL AIRCRAFT IN THE AIR TRAFFIC CONTROL SYSTEM Final Report**
Donald H. Turnbull Sep. 1975 58 p
(AD-A016666/0; FAA-RD-75-98) Avail: NTIS HC $4.25 CSCL 17/9

In response to a National Transportation Safety Board recommendation, an investigation was undertaken to develop and determine the practicality of small aircraft radar enhancement devices. The detection capability of present radars as well as an analysis and evaluation of passive radar enhancement devices and active radar enhancement devices are discussed. It is concluded that passive enhancement devices are not practical, and that active enhancement devices are too costly when compared to the existing Air Traffic Control Radar Beacon System (ATCRBS) transponders. The recommendations are that the ATCRBS should be promoted by the FAA, no further program efforts should be undertaken by the FAA on small enhancement and the development of the Moving Target Detector should be continued. Author

**N76-14100#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**DABS DOWNLINK CODING**
J. T. Barrows 12 Sep. 1975 41 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002; FAA Proj. 034-241-021)
(AD-A016356/8; FAA-RD-75-61; ATC-48) Avail: NTIS HC $3.75 CSCL 17/7

The encoding/decoding techniques incorporated into the Discrete Address Beacon System downlink design are summarized. It has been determined that the binary cyclic code used for the uplink is applicable to the downlink interference environment, thus rendering considerable hardware simplication in the transponder. The downlink environment leads to a characterization as a burst erasure channel, which allows the code to be used in a burst correction capacity. The error correction techniques including specific implementations are emphasized. Author

**N76-14101#** Systems Control, Inc., Palo Alto, Calif.
**WAYPOINT DESIGNATION STANDARDS Final Report**
R. J. Adams Aug. 1975 112 p refs
(Contract DOT-FA72WA-3098)
(AD-A016463/2; FAA-RD-75-122) Avail: NTIS HC $5.25 CSCL 17/7

A specific waypoint designator format and recommended waypoint location and identification standards are provided. The impact of the Task Force concepts on waypoint designation techniques and standards were evaluated. This was accomplished by thoroughly investigating the alternative techniques for waypoint identification and communication for both charted and impromptu operations. It was necessary to review, analyze and evaluate fourteen proposed waypoint designation techniques. The ultimate choice of a waypoint designator included provisions for three phases of RNAV implementation with a varying mix of charted and preplanned direct routes. The waypoint designator format had to be compatible with a wide range of airborne area navigation equipment, as well as, with pilot/controller communication practices. The waypoint designator technique has to accommodate diverse user applications covering the spectrum of general aviation, business and airline applications. Author

**N76-14102#** Ohio Univ., Athens. Avionics Engineering Center.
**INSTRUMENT LANDING SYSTEM MEASUREMENT PROGRAM Final Report, Oct. 1973 - Apr. 1975**
Apr. 1975 128 p refs
(Contract DOT-FA74WA-3371)
(AD-A016274/3; EER-22-1; FAA-RD-75-153) Avail: NTIS HC $5.75 CSCL 17/7

Results of an extensive series of experiments to determine the characteristics and performance of the Watts slotted-cable,

end-fire, glide-slope array are presented. Measurements made at the Tamiami ILS test site show that the Watts array will produce a flyable path for category 1 operations, but improvements are needed to give greater azimuth coverage of path information. Also, increased RF gain is needed to meet usable distance requirements when operating with solid state transmitting equipment. Image glide-slope systems and a slotted-cable localizer course array were also measured for performance characteristics and these items are discussed. For improved accuracy when tracking flight-check aircraft, two automatic tracking theodolites were designed, fabricated, and tested. The video-type tracker, suitable for night-time tracking, gave the greatest range of operation. A modification of the commonly used Warren Knight Model 83 theodolite was made to include drive motors operating on error signals derived from a photocell. Author

**N76-14103#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**IMPACT OF OBSTACLE SHADOWS ON MONOPULSE AZIMUTH ESTIMATE**
A. Spiridon 17 Jul. 1975 61 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002; FAA Proj. 034-241-012)
(AD-A015139/9; ATC-50) Avail: NTIS HC $4.25 CSCL 17/7

A radar beacon system is examined. Obstacle shadows, within view of a sensor using monopulse azimuth estimate, cause an error in the azimuth estimate. The azimuth error as a function of obstacle dimension and position, and the sensor antenna illumination are discussed. Photographs of obstacles (buildings, smokestacks) are shown. Author

**N76-14104#** Naval Electronics Lab. Center, San Diego, Calif. Propagation Technology Div.
**OMEGA MEASUREMENTS: FUCHU, JAPAN. OMEGA VLF PHASE DIFFERENCE DATA SERIES. VOLUME 12: DATA FOR PERIOD FEBRUARY 1968 - DECEMBER 1969**
E. R. Swanson, C. P. Kugel, and E. J. Hendricks 7 Apr. 1975 107 p refs Sponsored in part by Coast Guard (NELC Proj. A107)
(AD-A014071; NELC/TD-402-Vol-12) Avail: NTIS CSCL 17/7

This is one of a series of 27 volumes (NELC TD 391-417) presenting measurements of the relative phase difference of signals from various pairs of Omega stations as observed at several monitoring sites around the world. The volume includes measurements made in 1968 and 1969. Remote transmitters include Hawaii and Norway. GRA

**N76-14105#** Naval Electronics Lab. Center, San Diego, Calif. Propagation Technology Div.
**OMEGA MEASUREMENTS: TANANARIVE, MADAGASCAR. OMEGA VLF PHASE DIFFERENCE DATA SERIES. VOLUME 16: DATA FOR PERIOD SEPTEMBER 1969 - DECEMBER 1970**
E. R. Swanson, C. P. Kugel, and E. J. Hendricks 7 Apr. 1975 87 p refs Sponsored in part by Coast Guard (NELC Proj. A107)
(AD-A014072; NELC/TD-406-Vol-16) Avail: NTIS CSCL 17/7

This is one of a series of 27 volumes (NELC TD 391-417) presenting measurements of the relative phase difference of signals from various pairs of Omega stations as observed at several monitoring sites around the world. This volume describes measurements made in 1969 and 1970. Remote transmitters include Norway and Trinidad. GRA

**N76-14106#** Naval Electronics Lab. Center, San Diego, Calif. Propagation Technology Div.
**OMEGA MEASUREMENTS: FAA FLIGHTS, NORTH - SOUTH AMERICA. OMEGA VLF PHASE DIFFERENCE DATA SERIES. VOLUME 18: DATA FOR PERIOD MAY 1966 - MARCH 1967**
E. R. Swanson, C. P. Kugel, and E. J. Hendricks 7 Apr. 1975 54 p refs Sponsored in part by Coast Guard (NELC Proj. A107)
(AD-A014073; NELC/TD-408-Vol-18) Avail: NTIS CSCL 17/7

This is one of a series of 27 volumes (NELC TD 391-417) presenting measurements of the relative phase difference of signals from various pairs of Omega stations as observed at several monitoring sites around the world. The data in this volume were obtained from published reports of extensive Omega monitoring at 21 major airports throughout North and South America during the period from May 1966 to March 1967. In addition to obtaining fixed-site data, the purposes of the experiment were to determine the effect of precipitation static on the reception of Omega signals in aircraft and to investigate the problems of lane identification in the Omega system. GRA

**N76-14107#** Naval Electronics Lab. Center, San Diego, Calif. Propagation Technology Div.
**OMEGA MEASUREMENTS: TEXAS. OMEGA VLF PHASE DIFFERENCE DATA SERIES. VOLUME 19: DATA FOR PERIOD MARCH - NOVEMBER 1966**
E. R. Swanson, C. P. Kugel, and E. J. Hendricks 7 Apr. 1975 26 p refs Sponsored in part by Coast Guard (NELC Proj. A107)
(AD-A014074; NELC/TD-409-Vol-19) Avail: NTIS CSCL 17/7

This is one of a series of 27 volumes (NELC TD 391-417) presenting measurements of the relative phase difference of signals from various pairs of Omega stations as observed at several monitoring sites around the world. The data were obtained to evaluate the possible application of Differential Omega techniques to separation distances of up to 300 nmi. Data were obtained continuously at Tracor headquarters in Austin, Texas, while two identical mobile monitor trailers simultaneously obtained data at two other sites for about 5 days each. Five pairs of these 'simultaneous' sites exist, resulting data from 11 sites over the period 21 October to 27 November 1966. Also documented are additional data taken at the Tracor headquarters building in March and June of 1966 with earlier models of the 599 series VLF receiver. GRA

**N76-14108#** Naval Electronics Lab. Center, San Diego, Calif. Propagation Technology Div.
**OMEGA MEASUREMENTS: MIAMI, FLORIDA. OMEGA VLF PHASE DIFFERENCE DATA SERIES. VOLUME 20: DATA FOR PERIOD JANUARY - DECEMBER 1970**
E. R. Swanson, C. P. Kugel, and E. J. Hendricks 7 Apr. 1975 72 p refs Sponsored in part by Coast Guard
(AD-A014075; NELC/TD-410-Vol-20) Avail: NTIS CSCL 17/7

This is one of a series of 27 volumes (NELC TD 391-417) presenting measurements of the relative phase difference of signals from various pairs of Omega stations as observed at several monitoring sites around the world. The volume describes measurements from January 1970 through December 1970. Remote transmitters include Hawaii, New York, Norway, and Trinidad. GRA

**N76-14109#** Naval Electronics Lab. Center, San Diego, Calif.
**VLF NAVIGATION MONITOR: PURPOSE AND FUNCTION Final Report, Dec. 1973 - May 1975**
E. R. Swanson 30 May 1975 19 p refs
(Contract DOT-FA74WAI-425)
(AD-A013651; NELC-TR-1955) Avail: NTIS CSCL 17/7

An overview of the need for and the design of a VLF navigation monitor is presented. Fundamental errors associated with various VLF navigational techniques are discussed briefly; 2-mile accuracy or better is assumed typical. Safe operation within existing airways is normally possible, but protection against propagationally induced blunders should be provided by a navigation monitor. The monitor can be designed so as to provide not only disturbance warning but also disturbance prediction. The monitor can also assist in preflight. GRA

## 05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

**N76-14110#** Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
**EXPERIMENTAL INVESTIGATION OF MULTIPLE JET IMPINGEMENT FLOWS APPLICABLE TO VTOL AIRCRAFT IN GROUND EFFECT**
William G. Hill, Jr. and Richard C. Jenkins Nov. 1975 53 p refs
(RM-605) Avail: NTIS HC $4.50

The flow fields created by multiple jets impinging on a ground plane are investigated with primary emphasis on flows pertinent to VTOL aircraft. Experimental flows were produced by one, two, or four axisymmetric subsonic air jets. Initial tests were conducted to evaluate free mixing of multiple jet clusters without ground impingement. Whereas the multiple jets operating out of ground effect were found to have little influence on each other, significant mutual interference was found during ground impingement.
Author

**N76-14111#** National Aviation Facilities Experimental Center, Atlantic City, N.J.
**TEST AND EVALUATION OF WIRE-WOUND TACTICAL AIR NAVIGATION AID (TACAN) HEATED RADOMES WITH WEATHER SENSORS Interim Report, Dec. 1973 - Mar. 1974**
Harold Postel Sep. 1975 67 p
(FAA Proj. 042-306-000)
(AD-A015724/8; FAA-NA-74-45) Avail: NTIS HC $4.75 CSCL 09/5

Field evaluation at the Newberg, Oregon, Very High Frequency Omnirange Tactical Air Navigation Aid (VORTAC) of an engineering model wire-wound Tactical Air (TACAN) radome and weather sensing system is described. The evaluation was to determine the feasibility of the weather sensors and the wire-wound radome in preventing snow and/or ice buildup. Three TACAN system outages occurred under moderate weather conditions during the 3 months of testing because of snow or ice accumulation on the TACAN radome and monitor antenna faceplace. An apparent power reduction was realized over conventional internal radome heaters; however, more stringent on/off controls should be built into the heater, and production wire-wound radomes should be tested under more severe weather conditions. Author

**N76-14112*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**THERMAL CONDUCTANCE OF AND HEAT GENERATION IN TIRE-PAVEMENT INTERFACE AND EFFECT ON AIRCRAFT BRAKING**
C. David Miller Washington Jan. 1976 61 p refs
(NASA-TN-D-8094; E-8357) Avail: NTIS HC $4.50 CSCL 11J

A finite-difference analysis was performed on temperature records obtained from a free rolling automotive tire and from pavement surface. A high thermal contact conductance between tire and asphalt was found on a statistical basis. Average slip due to squirming between tire and asphalt was about 1.5 mm. Consequent friction heat was estimated as 64 percent of total power absorbed by bias-ply, belted tire. Extrapolation of results to aircraft tire indicates potential braking improvement by even moderate increase of heat absorbing capacity of runway surface. Author

**N76-14113*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**THRUST AND WING LOADING REQUIREMENTS FOR SHORT HAUL AIRCRAFT CONSTRAINED BY ENGINE NOISE AND FIELD LENGTH**
Jeffrey V. Bowles, Mark H. Waters, and Thomas L. Galloway Washington Jan. 1976 40 p refs
(NASA-TN-D-8144; A-6113) Avail: NTIS HC $4.00 CSCL 01A

Propulsion system and wing loading requirements are determined for a mechanical flap and an externally blown flap aircraft for various engine noise levels and two engine cycles. Both aircraft are sized to operate from a 914m (3000 ft) runway and perform the same mission. For each aircraft concept, propulsion system sizing is demonstrated for two different engine cycles - one having a fan pressure ratio of 1.5 and a bypass ratio of 9, and the other having a fan pressure ratio of 1.25 and a bypass ratio of 17.8. The results presented include the required thrust-to-weight ratio, wing loading, resulting gross weight, and direct operating costs, as functions of the engine noise level, for each combination of engine cycle and aircraft concept. Author

**N76-14114#** Bell Helicopter Co., Fort Worth, Tex.
**RESULTS OF HELICOPTER FLIGHT TESTS OF A CIRCUMFERENTIAL CARBON OIL SEAL Final Report, 1 Jan. 1973 - 1 Dec. 1974**
Charles A. Turner Jun. 1975 16 p
(Contract DAAJ02-73-C-0035; DA Proj. 1G1-62204-AA-72)
(AD-A013500; BHC-299-099-740; USAAMRDL-TR-75-23)
Avail: NTIS CSCL 11/1

Two samples of a circumferential carbon seal design underwent flight tests in UH-1 and AH-1 type helicopters. One sample was tested at Bell Helicopter's flight test facility and one sample was tested at Fort Rucker, Alabama. Both seals operated successfully with no reported leakage for a total of 435 hours. The seal tested at Bell Helicopter accrued 179 hours of successful operation in an AH-1G helicopter, including cold-weather testing down to -65F. The seal installed at Fort Rucker operated for 256 hours and at the time of this report was still operating satisfactorily. Author (GRA)

**N76-14115#** Kaman Aerospace Corp., Bloomfield, Conn.
**ELASTIC PITCH BEAM TAIL ROTOR STUDY FOR LOH CLASS HELICOPTERS Final Report**
John D. Porterfield and Frank B. Clark Feb. 1975 140 p refs
(Contract DAAJ01-73-C-0282)
(AD-A013501; R-1325) Avail: NTIS CSCL 01/3

This report studies the feasibility of using the flexural concept of the Elastic Pitch Beam in the design of tail rotors for LOH class helicopters. The goal is to provide reliability, maintainability, repairability, and performance characteristics that are improved over those of current designs. Specifically the designs studied included individually replaceable airfoil panels, a minimum number of bearings, elastomeric bearings where bearings are required, and composite materials to improve damage tolerance and repairability. Comparative analyses were used to select the preferred configuration to be subjected to further study.
Author (GRA)

**N76-14116#** Uniroyal Tire Co., Detroit, Mich.
**RADIAL PLY AIRCRAFT TIRES: DESIGN, CONSTRUCTION, AND TESTING Final Report, Dec. 1968 - Jan. 1975**
C. G. W. Spinti, J. J. Licus, D. J. Martin, and J. S. Wagner Jun. 1975 210 p
(Contract F33657-68-C-1292; WM Proj. 8-CIP-1913)
(AD-A013837; ASD-TR-75-23) Avail: NTIS CSCL 01/3

The object of the program was to develop basic, general, radial ply aircraft tire design parameters and construction techniques. Four (4) sizes of aircraft tires, 20x4.4/12, 30x8.8/22, 44x16/28 and 20.00-20/22 P.R. were selected for the study. A summary report of the literature survey and a design manual were issued for Phase I. A total of 81 tires were built of which 49 were tested. One 20x4.4/12 P.R. tire with revised tread shoulder configuration completed 200 mph qualification testing but the result could not be duplicated. Best performance was obtained on the 44x16/28 P.R. tires. An 8 actual ply 3 breaker tire completed 200 mph qualification testing. The principle mode of failure on dynamic tests was separation between the tread and breakers. Variations in the tread, breaker construction to improve dynamic performance were tested. GRA

**N76-14117#** Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
**EVALUATION OF AN OH-58A HELICOPTER WITH AN ALLISON 250-C20B ENGINE Final Report, 17 Oct. - 6 Dec. 1974**
Tom P. Benson, Robert M. Buckanin, Carl F. Mittag, and James E. Jenks, Jr. Apr. 1975 86 p refs
(AD-A013861; USAAEFA-74-48) Avail: NTIS CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a limited performance and handling qualities evaluation of a Bell Helicopter Company OH-58A helicopter with an Allison 250-C20B engine installed. The evaluation was conducted at Edwards Air Force Base and Bishop, California, from 17 October

through 6 December 1974. Twenty-two flights with 17.6 productive test hours were required for the evaluation. Test results obtained with the Allison 250-C20B engine were compared with those previously obtained with the Allison 250-C20 engine and the standard T63-A-700 engine. Primary performance improvement over the standard T63-A-700 engine was an increase in out-of-ground-effect hover ceiling from 4600 to 11,050 feet standard-day density altitude at a gross weight of 3000 pounds. One deficiency and five shortcomings were noted. Unsatisfactory handling qualities characteristics are inherent to the basic OH-58A helicopter and are not associated with the installation of the 250-C20B engine. The engine/airframe compatibility characteristics (cooling and vibration levels) of the OH-58A helicopter with the 250-C20B engine are similar to the standard OH-58A helicopter with the T63-A-700 engine. Within the scope of the test, the performance of the OH-58A helicopter with an Allison 250-C20B engine installed was improved over the basic OH-58A helicopter. Handling qualities were essentially unchanged. GRA

**N76-14118#** Instrument Flight Center, Randolph AFB, Tex.
**PILOT FACTORS FOR HELICOPTER REFINED ADI/HSI AND SUPPORTING DISPLAYS EVALUATION Final Report**
Gerald C. Armstrong, J. W. McCowell, Donald D. Sams, and F. J. Winter, Jr. Jun. 1975 210 p refs
(AD-A013796; IFC-TR-74-5) Avail: NTIS CSCL 01/3

This investigation was conducted to document pilot acceptance of improved displays for the standard light helicopter. Twenty-one helicopter pilots were given a technical briefing on the new displays and filled out a preflight questionnaire concerning their firsthand impressions. Sixteen of the twenty-one pilots received a familiarization flight with the new displays and filled out a postflight questionnaire giving their judgments and opinions. Five of the sixteen pilots were used as data collection pilots. These pilots flew profiles representing typical helicopter instrument maneuvers. Objective and subjective data were obtained through the use of video, audio, and oscillograph recording equipment. GRA

**N76-14119#** Lockheed-Georgia Co., Marietta.
**EVALUATION OF 3-D TURBULENCE TECHNIQUES FOR DESIGNING AIRCRAFT Final Report, 1 Oct. 1973 - 15 Apr. 1975**
Frederick D. Eichenbaum Jan. 1975 85 p refs
(Contract F33615-74-C-3004; AF Proj. 1367)
(AD-A013927; AFFDL-TR-74-151) Avail: NTIS CSCL 01/1

A recently developed multiple input power spectral technique is applied to predict the response of a C-5A aircraft to three-dimensional turbulence. Results are compared to the equivalent one-dimensional turbulence analysis, using corresponding C-5A dynamic response test data as a reference. Load variations range from an increase of 3% to a decrease of 14%. Because the coherence properties of the turbulence field are fully accounted for in the 3-d gust response analysis, theoretical results which depend upon the cross spectra between responses and probe-measured gust components tend to show a marked improvement over the 1-d case. GRA

**N76-14120#** Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
**A-3B SERIES AIRCRAFT STRUCTURAL FATIGUE LIFE MONITORING PROGRAM Final Report**
Gene L. Barndt 15 Jun. 1975 143 p
(AD-A013592; NADC-75035-30) Avail: NTIS CSCL 01/3

This report provides detailed information concerning the methodology required to establish a program that updates, through automatic data processing, the structural fatigue life status of A-3B series aircraft on an individual BUNO basis. Author (GRA)

**N76-14019** Royal Aircraft Establishment, Bedford (England).
**THE OPERATIONAL PROBLEMS ENCOUNTERED DURING PRECISE MANEUVERING AND TRACKING**
B. I. L. Hamilton *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 1-8 (For availability see N76-14018 05-01)

**N76-14022*** Advisory Group for Aerospace Research and Development, Paris (France).
**DYNAMIC RESPONSE OF AIRCRAFT STRUCTURE**
*In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 21-44 (For availability see N76-14018 05-01)
(Contract NAS2-6475)

**N76-14027** Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
**BUFFET FLIGHT TEST TECHNIQUES**
P. J. Butkewicz *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 91-98 (For availability see N76-14018 05-01)

**N76-14028** Royal Aircraft Establishment, Bedford (England).
**LIMITATIONS IN THE CORRELATION OF FLIGHT/TUNNEL BUFFETING TESTS**
D. G. Mabey *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 99-104 (For availability see N76-14018 05-01)

**N76-14029** Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
**INFLUENCE OF CONFIGURATION FACTORS ON BUFFETING**
H. Max *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 104-107 (For availability see N76-14018 05-01)

**N76-14030** Aeritalia, Turin (Italy).
**IMPROVEMENT OF AIRCRAFT BUFFET CHARACTERISTICS**
G. Bucciantini *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 108-110 (For availability see N76-14018 05-01)

**N76-14036** Advisory Group for Aerospace Research and Development, Paris (France).
**AIRCRAFT CHARACTERISTICS**
*In its* Approach and Landing Simulation Oct. 1975 p 14-15 (For availability see N76-14032 05-01)

# 06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

**N76-14121*#** General Research Corp., Santa Barbara, Calif.
**ADVANCED COST ESTIMATING AND SYNTHESIS TECHNIQUES FOR AVIONICS Final Report**
E. N. Dodson, E. E. Balkovich, and W. E. Waller Sep. 1975 186 p refs
(Contract NAS9-13573)
Avail: NTIS HC $7.50 CSCL 01D

For the costs of design, development, test and engineering, two methods of assessing costs are discussed. Each is based upon the analyst's determination of a summary set of performance or design variables which define the state-of-the-art (SOA) for the subsystem or equipment type under study. One method, called time regression, is recommended for use when the SOA-determining variables are interrelated, i.e., when a specific value of one variable can be specified only when values of the others are as well. Another method, called delta performance, is recommended for use when the SOA parameters are unrelated to one another. Author

**N76-14122*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**OPTICALLY COUPLED DIGITAL ALTITUDE ENCODER FOR GENERAL AVIATION ALTIMETERS**
Floyd R. Bryant Washington Dec. 1975 27 p refs
(NASA-TN-D-8118; L-10556) Avail: NTIS HC $4.00 CSCL 01D

An optically coupled pressure altitude encoder which can be incorporated into commercially available inexpensive general aviation altimeters was successfully developed. The encoding of

pressure altitude is accomplished in 100-ft (30.48-m) increments from -1000 to 20,000ft (-304.8 to 6096 m). The prototype encoders were retrofitted into two different internal altimeter configurations. A prototype encoder was checked for accuracy of transition points and environmental effects. Each altimeter configuration, with the encoder incorporated, was laboratory tested for performance and was subsequently flight-tested over the specified altitude range. With few exceptions, the assembled altimeter-encoder met aeronautical standards for altimeters and encoders. Design changes are suggested to improve performance to meet required standards consistently. Author

# 07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

**N76-14123*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SWIRL-CAN COMBUSTOR PERFORMANCE TO NEAR-STOICHIOMETRIC FUEL-AIR RATIO**
Larry A. Diehl and James A. Biaglow 1976 27 p refs Proposed for presentation at the 21st Ann. Intern. Gas Turbine Conf., New Orleans, 21-25 Mar. 1975; sponsored by ASME
(NASA-TM-X-71794; E-8471) Avail: NTIS HC $4.00 CSCL 21E

Emissions and performance characteristics were determined for full-annulus swirl-can modular combustors operated to near stoichiometric fuel air ratios. The purposes of the tests were to obtain stoichiometric data at inlet air temperatures up to 894 K and to determine the effect of module number by investigating 120 and 72 module swirl-can combustors. The maximum average exit temperature obtained with the 120-module swirl-can combustor was 2465 K with a combustion efficiency of 95 percent at an inlet-air temperature of 894 K. The 72-module swirl-can combustor reached a maximum average exit temperature of 2306 K with a combustion efficiency of 92 percent at an inlet air temperature of 894 K. At a constant inlet air temperature, maximum oxides of nitrogen emission index values occurred at a fuel-air ratio of 0.037 for the 72-module design and 0.044 for the 120-module design. The combustor average exit temperature and combustion efficiency were calculated from emissions measurements. The measured emissions included carbon monoxide, unburned hydrocarbons, oxides of nitrogen, and smoke. Author

**N76-14124*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**TURBINE BLADE METAL TEMPERATURE MEASUREMENT WITH A SPUTTERED THIN FILM CHROMEL-ALUMEL THERMOCOUPLE**
Curt H. Liebert, George A. Mazaris, and Henry W. Brandhorst, Jr. Dec. 1975 15 p refs
(NASA-TM-X-71844; E-8569) Avail: NTIS HC $3.50 CSCL 21E

A technique for fabricating Chromel and Alumel thin film thermocouples was developed. Turbine blade metal temperatures measured with the thin film thermocouple installation were compared with those of a reference sheathed (wire) thermocouple. Good agreement was obtained, and the results are encouraging. Author

**N76-14125#** Aeronautical Research Labs., Melbourne (Australia). Dept. of Supply.
**A THERMODYNAMIC ASSESSMENT OF A NON-RESONANT PULSE JET**
A. Runacres Jun. 1974 28 p refs
(ARL/ME-142) Avail: NTIS HC $4.00

The performance of a nonresonant pulse jet was investigated by means of a quasi-steady analysis on a digital computer. The computer model used thermodynamic equations developed in a similar work undertaken earlier to investigate the performance of a constant-volume gas turbine cycle. Results are given which agree broadly with those of an earlier idealized analysis, but the analysis is extended to investigate the effects of scavenging ratio, pulse shape, real gas properties and other factors affecting performance. It is shown that the major advantages of the nonresonant engine over the resonant unit are its ability to achieve ram precompression of the charge before combustion and the facility to select a combination of pulse frequency and geometrical factors in order to improve combustor scavenging. These factors improve the performance at high flight speeds and increase the ratio of thrust to volume. The engine is not expected to give static thrust but could find application, for example, to boost-launched drone aircraft. Author

**N76-14126#** Douglas Aircraft Co., Inc., Long Beach, Calif.
**AIRCRAFT NOISE DEFINITION. PHASE 1: ANALYSIS OF THE EXISTING DATA FOR THE DC-8, DC-9 AND DC-10 AIRCRAFT Final Report, Oct. 1972 - Aug. 1973**
J. S. Goodman Aug. 1973 255 p refs
(Contract DOT-FA73WA-3161)
(AD-A016278/4; MDC-J5973-Phase-1; FAA-EQ-73-5) Avail: NTIS HC $10.00 CSCL 01/3

Acoustic and performance data were processed and analyzed for: two JT3D turbofan-powered DC-8s, one with short and one with long fan ducts; two DC-9s, one with JT8D-7 and one with JT8D-9 engines; and the DC-10-10 and DC-10-40 aircraft. The acoustic data included reference-day effective perceived noise level and peak A-weighted sound level curves with empirically developed curves for adjusting the noise levels to temperatures from 30 F to 100 F with the relative humidity held constant at 70 percent. The performance data include provisions for a temperature variation from 30 F to 100 F and runway altitude from sea level to 6000 feet. Data accuracy is described in terms of assignable confidence limits. Author

**N76-14127*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**NNEP: THE NAVY NASA ENGINE PROGRAM**
Laurence H. Fishbach and Michael J. Caddy (Naval Air Develop. Center) Dec. 1975 36 p refs
(NASA-TM-X-71857; E-8606) Avail: NTIS HC $4.00 CSCL 21E

A computer code capable of simulating almost any conceivable turbine engine is described. This code uses stacked component maps and multiple flowpaths to simulate variable cycle engines with variable component geometry. It is capable of design and off-design (matching) calculations and can optimize free variables such as nozzle areas to minimize specific fuel consumption. Author

**N76-14128*#** Cabot Corp., Kokomo, Ind. Satellite Div.
**OPTIMIZATION OF AN OXIDE DISPERSION STRENGTHENED Ni-Cr-Al ALLOY FOR GAS TURBINE ENGINE VANES Final Report**
D. L. Klarstrom and R. Grierson Oct. 1975 104 p refs
(Contract NAS3-17806)
(NASA-CR-134901) Avail: NTIS HC $5.50 CSCL 21E

The investigation was carried out to determine the optimum alloy within the Ni-16Cr-Al-Y2O3 system for use as a vane material in advanced aircraft gas turbine engines. Six alloys containing nominally 4%, 5% and 6% Al with Y2O3 levels of 0.8% and 1.2% were prepared by mechanical attrition. Six small-scale, rectangular extrusions were produced from each powder lot for property evaluation. The approximate temperatures for incipient melting were found to be 1658 K (2525 F), 1644 K (2500 F) and 1630 K (2475 F) for the 4%, 5% and 6% aluminum levels, respectively. With the exception of longitudinal crystallographic texture, the eight extrusions selected for extensive evaluation either exceeded or were close to mechanical property goals. Major differences between the alloys became apparent during dynamic oxidation testing, and in particular during the 1366 K (2000 F) /500 hour Mach 1 tests carried out by NASA-Lewis. An aluminum level of 4.75% was subsequently judged to be optimum based on considerations of dynamic oxidation resistance, susceptibility to thermal fatigue cracking and melting point. Author

**N76-14129*#** General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
**ADVANCED SUPERSONIC PROPULSION SYSTEM TECHNOLOGY STUDY, PHASE 2 Final Report**
R. D. Allan Dec. 1975 94 p
(Contract NAS3-16950)
(NASA-CR-134913; R75AEG508) Avail: NTIS HC $5.00 CSCL 21E

Variable cycle engines were identified, based on the mixed-flow low-bypass-ratio augmented turbofan cycle, which has shown excellent range capability in the AST airplane. The best mixed-flow augmented turbofan engine was selected based on range in the AST Baseline Airplane. Selected variable cycle engine features were added to this best conventional baseline engine, and the Dual-Cycle VCE and Double-Bypass VCE were defined. The conventional mixed-flow turbofan and the Double-Bypass VCE were on the subjects of engine preliminary design studies to determine mechanical feasibility, confirm weight and dimensional estimates, and identify the necessary technology considered not yet available. Critical engine components were studied and incorporated into the variable cycle engine design. Author

**N76-14130*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**SOME COMPARISONS OF THE FLYOVER NOISE CHARACTERISTICS OF DC-9 AIRCRAFT HAVING REFANNED AND HARDWALLED JT8D ENGINES, WITH SPECIAL REFERENCE TO MEASUREMENT AND ANALYSIS PROCEDURES**
Robert N. Hosier Jan. 1976 80 p
(NASA-TM-X-72804) Avail: NTIS HC $5.00 CSCL 20A

Flyover noise measurements were made (using Federal Aviation Regulations, part 36 procedures) of two DC-9 aircraft, one equipped with refanned JT8D-109 engines and the other equipped with hardwalled JT8D-9 engines. NASA analyses show a refan centerline noise reduction of about 9.1 EPNdB and 10.0 EPNdB for takeoff with cutback and 50 deg. flap landing approach, respectively. A comparison of refan and hardwall PNLTM spectra shows that the refan noise reduction may be attributed to lower jet noise levels on takeoff and reduced high-frequency tonal content on landing approach. A general description of the test procedures and results are included along with detailed descriptions of the measurement and analysis systems. Author

**N76-14131*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**MEASUREMENT OF EXHAUST EMISSIONS FROM TWO J-58 ENGINES AT SIMULATED SUPERSONIC CRUISE FLIGHT CONDITIONS**
James D. Holdeman 1976 35 p refs To be presented at the 21st Intern. Gas Turbine Conf., New Orleans, La., 21-25 Mar. 1976; sponsored by ASME
(NASA-TM-X-71826; E-8490) Avail: NTIS HC $4.00 CSCL 21E

Emissions of total oxides of nitrogen, unburned hydrocarbons, carbon monoxide, and carbon dioxide from two J-58 afterburning turbojet engines at simulated high-altitude flight conditions are reported. Test conditions included flight speeds from Mach 2 to 3 at altitudes from 16 to 23 km. For each flight condition, exhaust measurements were made for four or five power levels from maximum power without afterburning through maximum afterburning. The data show that exhaust emissions vary with flight speed, altitude, power level, and radial position across the exhaust. Oxides of nitrogen (NOX) emissions decreased with increasing altitude, and increased with increasing flight speed. NOX emission indices with afterburning were less than half the value without afterburning. Carbon monoxide and hydrocarbon emissions increased with increasing altitude, and decreased with increasing flight speed. Emissions of these species were substantially higher with afterburning than without. Author

**N76-14132#** National Aviation Facilities Experimental Center, Atlantic City, N.J.
**SULFUR OXIDE MEASUREMENT IN AIRCRAFT TURBINE ENGINE EXHAUST Interim Report, Aug. 1974**
G. R. Slusher Sep. 1975 17 p refs
(FAA Proj. 201-521-010)
(AD-A016447/5; FAA-NA-75-10; FAA-RD-75-101) Avail: NTIS HC $3.25 CSCL 14/2

A limited investigation was conducted to measure the oxides of sulfur in aircraft turbine engine exhaust. The objective was to establish the ratio of sulfur trioxide to sulfur dioxide to be utilized in support of the climatic impact assessment program. The SO3 concentration was found to be 13.8 percent of the SO2 concentration as determined by wet chemistry analysis. Sulfur recovered in the samples was approximately 50 percent of the total sulfur in the fuel. Author

**N76-14133#** Aircraft Research Association, Ltd., Bedford (England).
**SIMULATION TECHNIQUES FOR PYLON-MOUNTED TURBO-FAN ENGINES, VOLUME 1**
A. E. Harris and G. I. Pauley Oct. 1975 93 p refs Sponsored by Min. of Defence., London
(ARA-36-Vol-1) Avail: NTIS HC $5.00

The effectiveness of the various nacelle simulators used to represent underslung turbofan engine nacelles is discussed in terms of the pressure interferences in evidence on wings and pylons for Mach numbers from 0.6 to 0.8. Drag data obtained from a typical powered nacelle test are presented together with a discussion of the thrust and drag bookkeeping used. A detailed description is given of the analysis of the powered nacelle internal and external characteristics. Equations involved in the thrust and drag analysis of the powered nacelle test data are included. Author

**N76-14134#** ARO, Inc., Arnold Air Force Station, Tenn.
**JET NOISE: A SURVEY AND A PREDICTION FOR SUBSONIC FLOWS Final Report, Jul. 1973 - Sep. 1974**
Philip T. Harsha AEDC Aug. 1975 78 p refs
(ARO Proj. RF438; ARO Proj. R32P)
(AD-A013794; ARO-ETF-TR-74-115; AEDC-TR-75-85) Avail: NTIS CSCL 20/1

The state-of-the-art of the prediction of turbulent jet noise is surveyed. This survey includes a description of the available experimental data on subsonic and supersonic, cold and hot jets, and of present theoretical treatments of the mechanisms of turbulent jet noise production. A detailed analysis of the production of subsonic cold jet noise, based on the acoustic analogy formulation, is described, and results of computations using this analysis and a turbulent kinetic energy analysis of the jet flow field are presented and compared with representative experimental data. GRA

**N76-14135#** RAND Corp., Santa Monica, Calif.
**PERFORMANCE/SCHEDULE/COST TRADEOFFS AND RISK ANALYSIS FOR THE ACQUISITION OF AIRCRAFT TURBINE ENGINES, APPLICATIONS OF R-1288-PR METHODOLOGY**
J. R. Nelson Jun. 1975 26 p refs
(Contract F44620-73-C-0011)
(AD-A013729; R-1781-PR) Avail: NTIS CSCL 21/5

The report discusses two applications of a cost-estimating model that incorporates quantitative measures of an engine's performance. A summary measure, called time of arrival (TOA), can be used in the decisionmaking process to trade off performance, schedule, and cost during the conceptual phase of aircraft turbine engines. The author briefly reviews the TOA measure and cost-estimating methodologies and then presents a tradeoff and risk analysis of two present-day programs: the Rolls Royce RB211 engine program and a new, hypothetical, afterburning turbofan engine program. The analysis indicates: (1) The cost growth for the RB211 was due to an ambitious British program, in terms of performance level demanded for the specific schedule desired. (2) A schedule requiring a new engine 'ahead of its time' results in a higher cost if it is achieved; it also exposes the engine, and the entire weapon system, to a higher risk of performance shortfall, schedule slippage, and cost growth. Future plans include an extension of the TOA methodology to the assessment of ownership costs for engines. GRA

**N76-14136#** General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
**INTEGRAL ENGINE INLET PARTICLE SEPARATOR. VOLUME 1: TECHNOLOGY PROGRAM Final Report**
Robert J. Duffy and Bernard F. Shattuck Jul. 1975 110 p refs

(Contract DAAJ02-73-C-0004; DA Proj. 1G1-62204-AA-7)
(AD-A013834; USSAAMRDL-TR-75-31A) Avail: NTIS CSCL 21/5

Volume I of this report describes the results of a 30-month program to design and evaluate integral engine inlet separators in 2, 5, and 15 lb/sec sizes. The separators are designed to remove sand, dust, and single foreign objects from the air entering a turboshaft engine. Program effort included: (1) Definition of turboshaft engine environment in terms of amounts and types of ingested materials. (2) Mechanical and aerodynamic design trade-off studies of integral engine separators followed by full-scale model performance tests of 2 and 15 lb/sec separators. (3) Detailed design and procurement of 2, 5, and 15 lb/sec separators, and design and procurement of improved components. (4) Model tests of the separators to obtain detailed aerodynamic and off-design performance data. (5) Preparation of a separator design guide for integral engine separators in the 2 to 15 lb/sec size range. The design guide (including environment definition) is presented in Volume II of this report. Volume I documents all other aspects of the program. GRA

# 08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

**N76-14137*#** National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
**STABILITY AND CONTROL DERIVATIVES OF THE T-37B AIRPLANE**
Mary F. Shafer Sep. 1975 31 p refs
(NASA-TM-X-56036) Avail: NTIS HC $4.00 CSCL 01C

Subsonic stability and control derivatives were determined by a modified maximum likelihood estimator from flight data for the longitudinal and lateral-directional modes of the T-37B airplane. Data from two flights, in which 166 stability and control maneuvers were performed, were used in the determination. The configurations investigated were: zero flaps, gear up; half flaps, gear up; full flaps, gear up; and zero flaps, gear down. Author

**N76-14138*#** Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
**APPLICATION OF ACTIVE CONTROLS TECHNOLOGY TO AIRCRAFT BIDE SMOOTHING SYSTEMS**
Maris Lapins and Ira D. Jacobson May 1975 211 p refs
(Grant NGR-47-005-202)
(NASA-CR-145980; ESS-4039-106-75) Avail: NTIS HC $7.75 CSCL 01C

A critical review of past efforts in the design and testing of ride smoothing and gust alleviation systems is presented. Design trade offs involving sensor types, choice of feedback loops, human comfort, and aircraft handling-qualities criteria are discussed. Synthesis of a system designed to employ direct-lift and side-force producing surfaces is reported. Two STOL aircraft and an executive transport are considered. Theoretically predicted system performance is compared with hybrid simulation and flight test data. Pilot opinion rating, pilot workload, and passenger comfort rating data for the basic and augmented aircraft are included. Author

**N76-14139*#** Boeing Commercial Airplane Co., Seattle, Wash.
**FLEXSTAB: A SUMMARY OF THE FUNCTIONS AND CAPABILITIES OF THE NASA FLEXIBLE AIRPLANE ANALYSIS COMPUTER SYSTEM An Early Domestic Dissemination Report**
E. N. Tinoco and J. E. Mercer Washington NASA Dec. 1975 41 p refs
(Proj. FEDD; Contract NAS2-5006)
(NASA-CR-2564; D6-41098) Avail: NASA Industrial Applications Centers only to U.S. Requesters: HC $4.00/MF $2.25 CSCL 01C

A brief description is provided of NASA's aeroelastic stability and control computer program - FLEXSTAB. Information is provided to aid potential users in evaluating possible use of FLEXSTAB. A summary of the program's capabilities, the scope and limitations of its formulation, and a description of its documentation are provided. Computer program hardware and software requirements and recent user experience are also discussed. Author

**N76-14140#** National Aeronautical Lab., Bangalore (India).
**ANALYSIS OF VISUAL THRESHOLD EFFECT ON MANUAL AIRCRAFT CONTROL**
G. R. Sarma and Y. N. Bapat 11 Sep. 1975 29 p refs Backup document for AIAA Synoptic scheduled for publication in the Journal of Aircraft in Feb. 1976
Avail: NTIS HC $4.00

The conditions under which stable pilot induced oscillations (PIO) are likely to be developed in a pilot-vehicle system if there are threshold effects in the visual display to the pilot are established. Pitch attitude control in the landing approach phase of an aircraft control in the longitudinal mode is considered. The extension is based on the fact that if nearly sinusoidal oscillations are developed in the pilot-vehicle system, what the pilot would probably be perceiving will not be a pure sinusoidal motion (due to limitations of the display) but a distorted output motion. The analysis indicates that the display threshold could give rise to the so called PIO depending upon the particular aircraft dynamics and pilot adapted equalization. The effect of the display threshold is to impose larger gain margin requirements in the pilot-vehicle system thereby severely restricting the variations in the pilot's gain to keep out of PIO. Author

**N76-14141#** Calspan Corp., Buffalo, N.Y.
**FLIGHT INVESTIGATION OF FIGHTER SIDE-STICK FORCE-DEFLECTION CHARACTERISTICS Final Report, Sep. 1974 - May 1975**
G. Warren Hall and Rogers E. Smith May 1975 94 p refs
(Contract F33615-73-C-3051; AF Proj. 8219)
(AD-A013926; CALSPAN-AK-5280-F-B; AFFDL-TR-75-39)
Avail: NTIS CSCL 01/3

A flight investigation of fighter side-stick controller force-deflection characteristics was performed using the USAF NT-33A variable stability airplane equipped with a variable feel side stick. The simulated airplane and control system characteristics were representative of a modern high performance fighter employing a side-stick controller. Up-and-away tasks including formation, air-to-air tracking and acrobatic maneuvering, and landing approach tasks were evaluated by two pilots. Four values of nonlinear pitch and roll side-stick force-command gain resulting in different response per force ratios were evaluated with different side-stick force-deflection gradients, including a rigid side stick. GRA

**N76-14142#** Illinois Univ., Urbana. Aviation Research Lab.
**PILOT PERFORMANCES AND PREFERENCES WITH A PERFORMANCE CONTROL SYSTEM Interim Scientific Report**
Craig Alan Bergman Apr. 1975 44 p refs
(Contract F44620-70-C-0105)
(AD-A013841; ARL-75-5/AFOSR-75-2; AFOSR-75-1186TR)
Avail: NTIS CSCL 01/3

Pilot performance and preference measures were obtained for 12 pilots in actual flight operations using a twin-engine general aviation aircraft with either conventional controls or a Performance Control System (PCS). The PCS provides a zero-order control of aircraft bank angle and vertical speed over the ranges of plus or minus 60 deg and plus or minus fpm, respectively. An information processing side-task was also used. With the PCS, flight error scores were reliably lower than with conventional aircraft controls. Pilot preferences, using a six-point scale ranging from 'slight' to 'moderate' to 'strong' preference for each of the two control systems, showed a 'moderate preference for the PCS' as the median response. GRA

**N76-14023** Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
**STABILITY AND CONTROL STATUS FOR CURRENT FIGHTERS**
W. G. Williams and J. L. Lockenour *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering

Combat Aircraft Jul. 1975 p 45-53 (For availability see N76-14018 05-01)

**N76-14024** Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
**STABILITY AND CONTROL POTENTIAL FOR FUTURE FIGHTERS**
J. L. Lockenour and W. G. Williams *In* AGARD The Effect of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft 1975 p 54-62 (For availability see N76-14018 05-01)

# 09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

**N76-14143#** National Aviation Facilities Experimental Center, Atlantic City, N.J.
**EFFECTIVENESS OF A PILOT GROUND TRAINER AS A PART TASK INSTRUMENT FLIGHT RULES FLIGHT-CHECKING DEVICE, STAGE 1 Interim Report, Apr. - Sep. 1974**
Robert J. Ontiveros Sep. 1975 51 p
(FAA Proj. 184-530-020)
(AD-A015722/2; FAA-NA-74-51; FAA-RD-75-36) Avail: NTIS HC $3.75 CSCL 05/9

The first stage of a two-stage experiment was conducted at the National Aviation Facilities Experimental Center (NAFEC) to determine the effectiveness of a pilot ground trainer for training noninstrument-rated pilots in instrument approaches and related instrument flight procedures. Ten private pilots were trained to perform very high frequency omnirange station (VOR), automatic direction finder (ADF), and instrument landing system (ILS) approaches. The pilot ground trainer represented a single-engine general aviation aircraft. The subjects' flight performance capability, achieved through ground trainer instruction, was evaluated by a flight check in an instrument-equipped Cessna 172. The results of this first stage of investigation indicate a positive transfer of training between observed pilot performance in the ground trainer and observed pilot performance in the aircraft for performing instrument flight approaches. Author

**N76-14144#** National Aviation Facilities Experimental Center, Atlantic City, N.J.
**JET BLAST FENCE INVESTIGATION AT JOHN F. KENNEDY INTERNATIONAL AIRPORT Final Report, May 1973 - Dec. 1974**
Guenther H. Christiansen Aug. 1975 33 p
(FAA Proj. 214-531-030)
(AD-A015086/2; FAA-RD-75-121; FAA-NA-75-36) Avail: NTIS HC $3.75 CSCL 01/5

A blast fence installed at the departure end of runway 31L at John F. Kennedy International Airport intended to protect aircraft landing on runway 4R from the effects of jet blast was believed to be ineffective. Tests were conducted using smoke to aid in flow visualization and using instrumentation to determine whether or not a jet blast was present on runway 4R behind the blast fence. Results confirmed the presence of a jet blast. Tests covered seven aircraft types and indicated maximum blast velocities at runway 4R of 35 miles per hour above ambient wind. Author

**N76-14145*#** Oceanics, Inc., Plainview, N.Y.
**EXPERIMENTAL VERIFICATION THAT AT MACH ONE WIND TUNNEL WALL INTERFERENCE DECREASES WITH MODEL THICKNESS Interim Report**
Theodore R. Goodman and August F. Lehman Jun. 1975 35 p refs
(Contract F44620-72-C-0079; AF Proj. 9781)
(AD-A013804; AFOSR-75-1174TR; Rept-75-117) Avail: NTIS CSCL 14/2

In an earlier analytical investigation it had been hypothesized that at Mach one thick models experience less wind tunnel wall interference than thin ones. This experimental study, performed with a water table having adjustable porosity sidewalls, utilizes the hydraulic analogy to verify the hypothesis. The pressure distribution on three affinely similar models, each having the same chord but with different thicknesses, was measured at several different settings of wall porosity. The hypothesis was verified in two ways: First, by comparing the pressure coefficient distribution for the three models at different wall porosities, second, by comparing the fluctuation of the normalized pressure coefficient for wall porosity at many chordwise stations. GRA

**N76-14146#** Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
**USAF SKID RESISTANCE PROGRAMS: A STATUS SUMMARY**
William V. Tracy, Jr. Mar. 1975 34 p refs
(AF Proj. 5549)
(AD-A013725; ASD-TR-75-14) Avail: NTIS CSCL 01/5

The report is a status summary of the USAF Skid Resistance Programs. Numerous programs have been conducted within the USAF and by joint USAF, FAA, and NASA agreements. Pavement grooving appears to be the best deterrent to aircraft hydroplaning, but must be reviewed in a cost effective manner and at best is a long term solution. The AFCEC Skid Resistance and Hydroplaning Potential Runway Evaluation Program is excellent and is a short term solution, but in itself cannot correct runway deficiencies but only point out the most critical ones. The method of predicting aircraft stopping distance derived in Combat Traction II, Phase II is very promising but requires additional analytical verification and clarification along with flight testing. GRA

**N76-14147#** Naval Air Engineering Center, Lakehurst, N.J. Engineering Dept. (SI).
**E-28 ARRESTING GEAR PURCHASE TAPE SERVICE LIFE EXTENSION Interim Report, May 1970 - Jun. 1975**
John Drulle 8 Aug. 1975 29 p refs
(AD-A013593; NAEC-ENG-7879) Avail: NTIS CSCL 01/5

This report presents a study of tensile test data obtained from E-28 Arresting Gear purchase tapes which had been granted service life extensions in field use. The results of this study show that in certain cases the service life can be increased. Author (GRA)

**N76-14148#** General Dynamics/Convair, San Diego, Calif. Aerospace Div.
**A STUDY OF EXPECTED DATA PRECISION IN THE PROPOSED AEDC HIRT FACILITY Final Report, Apr. 1973 - Jan. 1974**
J. R. Picklesimer, W. H. Lowe, and D. P. Cumming Aug. 1975 64 p refs
(Contract F40600-72-C-0015)
(AD-A013814; CASD-AFS-73-008; AEDC-TR-75-61) Avail: NTIS CSCL 14/2

AEDC has proposed an 8 x 10 foot Transonic Wind Tunnel (HIRT) operating on a Ludwieg tube concept. This facility is designed to meet the need to properly simulate the full-scale Reynolds numbers of current and future aircraft. HIRT differs from conventional wind tunnels in the characteristics of short run duration, high operating pressures, low temperatures and high aerodynamic loads. The purpose of this study was to assess the precision of the test data expected from HIRT and to examine HIRT to determine if its mode of operation would adversely affect data precision. It was assumed that the precision of the drag measurement could be used as the yardstick for evaluating over-all precision of facility test data. To establish a baseline from which the predicted precision of model gleaned in HIRT could be compared, a transonic tunnel data accuracy questionnaire was completed by five leading domestic transonic facilities. The responses to this questionnaire are summarized in this report. GRA

**N76-14037** Advisory Group for Aerospace Research and Development, Paris (France).
**VISUAL AND MOTION CUES**

*In its* Approach and Landing Simulation Oct. 1975 p 15-19
(For availability see N76-14032 05-01)

# 12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

**N76-14149*** National Aeronautics and Space Administration, Washington, D.C.
**COMMUNICATIONS TECHNOLOGY SATELLITE**
11 Jan. 1976 48 p
(NASA-News-Release-75-316; P75-10314) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

A description of the Communications Technology Satellite (CTS), its planned orbit, its experiments, and associated ground facilities was given. The communication experiments, to be carried out by a variety of groups in both the United States and Canada, include tele-education, tele-medicine, community interaction, data communications and broadcasting. A historical summary of communications satellite development was also included. Y.J.A.

**N76-14150*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**APOLLO SCIENTIFIC EXPERIMENTS DATA HANDBOOK**
W. F. Eichelman, ed. and W. W. Lauderdale, ed. (Gen. Elec. Co. Houston, Tex.) Aug. 1974 898 p
(NASA-TM-X-58131; JSC-09166) Avail: NTIS HC$21.25 CSCL 22A

A brief description of each of the Apollo scientific experiments was described, together with its operational history, the data content and formats, and the availability of the data. The lunar surface experiments described are the passive seismic, active seismic, lunar surface magnetometer, solar wind spectrometer, suprathermal ion detector, heat flow, charged particle, cold cathode gage, lunar geology, laser ranging retroreflector, cosmic ray detector, lunar portable magnetometer, traverse gravimeter, soil mechanics, far UV camera (lunar surface), lunar ejecta and meteorites, surface electrical properties, lunar atmospheric composition, lunar surface gravimeter, lunar seismic profiling, neutron flux, and dust detector. The orbital experiments described are the gamma-ray spectrometer, X-ray fluorescence, alpha-particle spectrometer, S-band transponder, mass spectrometer, far UV spectrometer, bistatic radar, IR scanning radiometer, particle shadows, magnetometer, lunar sounder, and laser altimeter. A brief listing of the mapping products available and information on the sample program were also included. Author

# 13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

**N76-14151*#** McDonnell-Douglas Technical Services Co., Inc., Houston, Tex. Astronautics Div.
**PPP/NONREAL-TIME TRAJECTORY PROGRAM INTERFACE REQUIREMENTS AND CAPABILITIES**
J. L. McGavern and James D. Arbet 28 Nov. 1975 12 p refs
(Contract NAS9-14780)
(NASA-CR-144644; DN-14) Avail: NTIS HC $3.50 CSCL 22C

The selection process for interfacing a nonreal time trajectory program with the procedures and performance program is outlined; the interface provides summary data timelines for any desired trajectory profile. Consideration was given to two separate digital programs for satisfying capabilities. One was the CDC 6400 digital program BANDITO, and the second was the UNIVAC 1110 SVDS program. Author

**N76-14152*#** TRW Systems Group, Redondo Beach, Calif.
**PRECISION ATTITUDE DETERMINATION SYSTEM (PADS) DESIGN AND ANALYSIS. TWO-AXIS GIMBAL STAR TRACKER Final Technical Report**
1 Jul. 1973 163 p refs
(Contract NAS5-21111)
(NASA-CR-144704; TRW-13900-6014-RU-00) Avail: NTIS HC $6.75 CSCL 22C

Development of the Precision Attitude Determination System (PADS) focused chiefly on the two-axis gimballed star tracker and electronics design improved from that of Precision Pointing Control System (PPCS), and application of the improved tracker for PADS at geosynchronous altitude. System design, system analysis, software design, and hardware design activities are reported. The system design encompasses the PADS configuration, system performance characteristics, component design summaries, and interface considerations. The PADS design and performance analysis includes error analysis, performance analysis via attitude determination simulation, and star tracker servo design analysis. The design of the star tracker and electronics are discussed. Sensor electronics schematics are included. A detailed characterization of the application software algorithms and computer requirements is provided. Author

**N76-14153#** Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
**ORBIT DETERMINATION IN THE PRESENCE OF UNMODELED ACCELERATIONS Final Report, 1 Dec. 1971 - 1 Nov. 1974**
B. D. Tapley 1975 18 p refs
(Grant AF-AFOSR-2233-72; AF Proj. 9769)
(AD-A013842; AFOSR-75-1073TR) Avail: NTIS CSCL 22/3

This report summarizes the results of three years work on Grant AFOSR 72-2233. Based on the results obtained during the course of study, it can be concluded that using observations from topocentric tracking stations, the Dynamic Model Compensation Method can be used to obtain an accurate approximation of the unmodeled aerodynamic forces acting on a space vehicle due to (1) uncertainties in the atmospheric model and (2) variations in the drag parameter. The accuracy of the estimate will be influenced by the accuracy and density of the observations and the tracking station distribution. The observation accuracy requirements for successful implementation require participating satellites; that is, accurate estimates of the density cannot be obtained with 'skintrack' or passive observations. However, there are alternate formulations which hold potential for drag estimation using passive satellite observations. GRA

**N76-14154#** Radio Corp. of America, Patrick AFB, Fla. Missile Test Project.
**TRANSFORMATIONS APPLICABLE TO MISSILE AND SATELLITE TRAJECTORY COMPUTATIONS Final Report, Jun. 1974 - Jun. 1975**
John J. OConnor Jul. 1975 320 p refs
(Contract F08606-72-C-0030)
(AD-A013969; AFETR-TR-75-29) Avail: NTIS CSCL 22/3

This report is a self-contained treatment of transformations with applications to missile and satellite technology. Numerous examples are included in the areas of specific tracking systems, geodetic transformations, earth-fixed and inertial systems, time transformations, transformations of a statistical nature and error analysis. GRA

# 14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

**N76-14155*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. VOLUME 4: PIONEER 10, FROM JANUARY 1974 - JANUARY 1975 AND PIONEER 11, FROM 1 MAY 1973 THROUGH JUPITER ENCOUNTER PERIOD**

**JANUARY 1975**
R. B. Miller, W. R. Barton, E. A. Cloonan, and J. C. Nash 1 Dec. 1975 133 p refs
(Contract NAS7-100)
(NASA-CR-145920; JPL-TM-33-584-Vol-4) Avail: NTIS HC $6.00 CSCL 14B

The Tracking and Data Systems support of Pioneer 10 from January 1974 through January 1975 is described along with Pioneer 11 support from May 1973 through Jupiter encounter. Topics covered include: operations in the interplanetary environment from the time of completion of the second trajectory correction to the start of Jupiter encounter; the implementation, planning, and testing that led to Jupiter encounter; and the operations during the 60-day encounter period for Pioneer 11. Author

**N76-14156*#** Technicolor Graphic Services, Inc., Houston, Tex.
**DYE FADING TEST FOR MISSION CONTROL OPERATOR CONSOLE DISPLAYS**
Harold E. Lockwood Dec. 1975 10 p
(Contract NAS9-11500)
(NASA-CR-144643) Avail: NTIS HC $3.50 CSCL 14B

A dye fading test of 40 days duration was conducted to determine the effect of mission control operator console and ambient lighting effects on a series of photographic products under consideration for use in mission console operator consoles. Six different display samples, each containing 36 windows of several different colors, were prepared and placed in the mission control consoles for testing. No significant changes were recorded during the testing period. All changes were attributed to a mechanical problem with the densitometer. Detailed results are given in graphs. Author

**N76-14157*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**ABSOLUTE CALIBRATION OF A HYDROGEN DISCHARGE LAMP IN THE VACUUM ULTRAVIOLET**
John E. Nealy Washington Dec. 1975 31 p refs
(NASA-TM-X-3327; L-10699) Avail: NTIS HC $4.00 CSCL 09C

A low-pressure hydrogen discharge lamp was calibrated for radiant intensity in the vacuum ultraviolet spectral region on an absolute basis and was employed as a laboratory standard source in spectrograph calibrations. This calibration was accomplished through the use of a standard photodiode detector obtained from the National Bureau of Standards together with onsite measurements of spectral properties of optical components used. The stability of the light source for use in the calibration of vacuum ultraviolet spectrographs and optical systems was investigated and found to be amenable to laboratory applications. The lamp was studied for a range of operating parameters; the results indicate that with appropriate peripheral instrumentation, the light source can be used as a secondary laboratory standard source when operated under preset controlled conditions. Absolute intensity measurements were recorded for the wavelengths 127.7, 158.0, 177.5, and 195.0 nm for a time period of over 1 month, and the measurements were found to be repeatable to within 11 percent. Author

**N76-14298*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Systems Engineering Office.
**VIKING MISSION SUPPORT**
D. J. Mudgway, A. I. Bryan, and D. W. Johnston *In its* The Deep Space Network 15 Oct. 1975 p 10-14 refs (For availability see N76-14296 05-31)
CSCL 22D

**N76-14299*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Systems Engineering Office.
**HELIOS MISSION SUPPORT**
P. S. Goodwin, W. G. Meeks, S. E. Reed, and R. E. Morris *In its* The Deep Space Network 15 Oct. 1975 p 15-19 ref (For availability see N76-14296 05-31)
CSCL 22D

# 15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

**N76-14158*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**ANNULAR MOMENTUM CONTROL DEVICE USED FOR STABILIZATION OF SPACE VEHICLES AND THE LIKE Patent**
Willard W. Anderson and Nelson J. Groom, inventors (to NASA) Issued 28 Oct. 1975 6 p Filed 1 Aug. 1973 Supersedes N73-28646 (11 - 19, p 2318)
(NASA-Case-LAR-11051-1; US-Patent-3,915,416; US-Patent-Appl-SN-384773; US-Patent-Class-244-165; US-Patent-Class-74-5.7; US-Patent-Class-244-3.21) Avail: US Patent Office CSCL 22B

An annular momentum storage device for stabilization of space vehicles about two axes perpendicular to the axis of rotation of the annular momentum storage device is described. The body of the vehicle is centrally located within the annulus of an annular shaped rotating inertial mass. Magnetic bearings support the inertial mass and are attached to a toroidal shaped housing which encloses the inertial mass. A linear induction motor is mounted along either the inner or outer periphery of the inertial mass for driving the same. Suitable projecting members are attached between the centrally located body of the vehicle and the housing containing the inertial mass.
Official Gazette of the U.S. Patent Office

**N76-14159*#** Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
**LAGEOS ASSEMBLY OPERATION PLAN**
J. Brueger Oct. 1975 41 p ref
(Contract NAS8-30658)
(NASA-CR-144096; LAGEOS-73) Avail: NTIS HC $4.00 CSCL 22B

Guidelines and constraints procedures for LAGEOS assembly, operation, and design performance are given. Special attention was given to thermal, optical, and dynamic analysis and testing. The operation procedures illustrate the interrelation and sequence of tasks in a flow diagram. The diagram also includes quality assurance functions for verification of operation tasks. E.H.W.

**N76-14160*#** Computer Sciences Corp., Silver Spring, Md.
**MATHEMATICAL FORMULATION OF THE APPLICATIONS TECHNOLOGY SATELLITE-F (ATS-F) ORBITAL MANEUVER CONTROL PROGRAM (CNTRLF)**
C. E. Goorevich Jul. 1975 86 p refs
(Contract NAS5-11999)
(NASA-CR-144703; CSC/SD-75/6020) Avail: NTIS HC $5.00 CSCL 22C

The mathematical formulation is presented of CNTRLF, the maneuver control program for the Applications Technology Satellite-F (ATS-F). The purpose is to specify the mathematical models that are included in the design of CNTRLF. Author

# 16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

**N76-14161*#** Aerospace Corp., El Segundo, Calif. Vehicle Systems Div.
**STS SPIN-STABILIZED UPPER STAGE STUDY (STUDY 2.6). VOLUME 1: EXECUTIVE SUMMARY Final Report**
30 Sep. 1975 46 p
(Contract NASw-2727)
(NASA-CR-145907; ATR-75(7367)-1-Vol-1) Avail: NTIS HC $4.00

Spinning solid propellant upper stage rocket engines designed

for geosynchronous satellite payloads are investigated. Factors considered include: impact of the spinning stages on the payloads; applicability to 1981-1991 NASA mission model; and cost effectiveness. J.M.S.

**N76-14162*#** Aerospace Corp., El Segundo, Calif. Vehicle Systems Div.
**STS SPIN-STABILIZED UPPER STAGE STUDY (STUDY 2.6). VOLUME 2: TECHNICAL REPORT Final Report**
30 Sep. 1975 469 p refs
(Contract NASw-2727)
(NASA-CR-145908; ATR-75(7367)-1-Vol-2) HC $12.00 CSCL 22B

For abstract, see N76-14161.

# 17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

**N76-14163#** Communications Research Centre, Ottawa (Ontario). Space Applications Branch.
**COMPUTER SIMULATION AND EXPERIMENTAL STUDIES OF THE PERFORMANCE OF A 2PHI-DPSK MODEM OVER A SATELLITE CHANNEL**
C. Loo and S. M. Chow Sep. 1975 15 p refs
(CRC-TN-675) Avail: NTIS HC $3.50

A comparison between experimental and calculated performance (fast Fourier transform) in terms of probability of error of a two phase differential phase shift keying over a nonlinear satellite channel is described in this paper. The channel nonlinearity is a travelling-wave tube (TWT) operated near or at saturation. The TWT is modeled by a single frequency-dependent nonlinearity whose parameters are based on results from measurement. In addition, measured frequency responses of the transmit and receive filters are used in the simulation. The results obtained show that the measured and simulated values agree very well in the region of normal operation and thus indicate that the simulation technique is useful in practical situations. Block diagrams are shown. Author

**N76-14164*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ASTP ONBOARD VOICE TRANSCRIPTION**
Sep. 1975 673 p
(NASA-TM-X-72912; JSC-09966) Avail: NTIS HC$16.25 CSCL 17B

The transcription is presented of the Apollo-Soyuz Test Project voice communications as recorded on the command module data storage equipment. Data from this recorder are telemetered (dumped) to Space Tracking and Data Network sites for retransmission to the Johnson Space Center. The transcript is divided into three columns -- time, speaker, and text. The Greenwich mean time column consists of three two-digit numbers representing hours, minutes, and seconds (e.g., 22 34 14) for the Julian dates shown at the top of the page on which a new day begins. The speaker column indicates the source of a transmission; the text column contains the verbatim transcript of the communications. Author

**N76-14165*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**ASTP TECHNICAL AIR-TO-GROUND VOICE TRANSCRIPTION**
Jul. 1975 1083 p refs
(NASA-TM-X-72914; JSC-09815) Avail: NTIS HC$28.25 CSCL 17B

The transcription of the technical air-to-ground voice communication of the Apollo-Soyuz Test Project mission was presented. The transcript was divided into three columns giving, respectively, the time, speaker, and text. All times are expressed in Greenwich mean time for the appropriate Julian dates. The speaker column indicates the source of transmission; the text column contains the verbatim transcript of the communications. Special symbols were used to report garbling, pauses or self-interruptions, interruptions by other speakers or abrupt terminations, emphasized words, obliterations, and material translated from Russian. Author

**N76-14297*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Office of Tracking and Data Acquisition.
**DSN FUNCTIONS AND FACILITIES AND DSN COMMAND SYSTEM MARK 3-75**
N. A. Renzetti and W. G. Stinnett *In its* The Deep Space Network 15 Oct. 1975 p 1-9 (For availability see N76-14296 05-31) CSCL 17B

# 18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

**N76-14166** Institute of Environmental Sciences, Mt. Prospect, Ill.
**PROCEEDINGS OF 2D AEROSPACE TESTING SEMINAR**
18 Mar. 1975 326 p refs Prepared in cooperation with Aerospace Corp., El Segundo, Calif.
(LC-62-38584) Avail: Issuing Activity

Acceptance and environmental testing concepts for space vehicles and spacecraft components are discussed. For individual titles, see N76-14167 through N76-14185.

**N76-14167** Aerospace Corp., El Segundo, Calif.
**OVERVIEW MIL-STD-1540A TEST REQUIREMENTS FOR SPACE VEHICLES**
*In its* Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 23 p (For availability see N76-14166 05-18)

Provided is a standard baseline for space vehicle program ground test requirements oriented toward low risk, long life space programs. The funnel effect aids in early problem identification/correction. Author

**N76-14168** Space and Missile Systems Organization, Los Angeles Air Force Station, Calif.
**APPLICATION OF MIL-STD-1540**
L. L. Jepsen *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 33 p (For availability see N76-14166 05-18)

Intents and purposes of the standard ground testing program for aerospace vehicles are outlined. The comprehensive testing baseline provides quality and acceptance test tables for low risk, long lifetime satellites and orbital vehicles. Requirements are mostly also valid for launch boosters or shorter lifetime orbital systems. G.G.

**N76-14169** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**EFFECTIVENESS OF SPACECRAFT SYSTEM ACCEPTANCE TESTING**
P. F. Brown *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 20 p (For availability see N76-14166 05-18)

Results of a 5 year investigation into the causes of system acceptance test failures cover data from histories of 46 spacecraft. Findings indicate that workmanship was the most frequent cause of test failures, followed by parts failures and design failures. It is concluded that lower level test perceptiveness needs improvement. G.G.

**N76-14170*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**TEST AND SPACE EXPERIENCE WITH PROTOFLIGHT SPACECRAFT**
A. R. Timmins *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 11 p refs (For availability see N76-14166 05-18)

Based on system level test results, there appears to be some additional risk of space failures when a protoflight spacecraft is launched in lieu of a flight spacecraft. The space performance of all protoflight spacecraft to date has been satisfactory with failure rates slightly less than conventional flight spacecraft. The continued use of the protoflight concept is supported by this study. Author

**N76-14171*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**VIKING 1975 ORBITER DEVELOPMENT TEST MODEL/ LANDER DYNAMIC TEST MODEL, DYNAMIC ENVIRONMENTAL TESTING**
George Milder *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 19 p (For availability see N76-14166 05-18)
(Contract NAS7-100)

A series of dynamic environmental tests on the Viking 1975 Orbiter/Lander model provided information regarding damping and linearity. The quality of mode isolation was made with orthogonality checks. A pretest criterion established for orthogonality provided good correlation with test results. Part of the post-test analysis was dedicated to a review of instrumentation selection for control and/or response limiting. Limited load values were also examined. Author

**N76-14172** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**SPACECRAFT FACTORY-TO-PAD TESTING CONCEPT**
R. H. Jones *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 15 p (For availability see N76-14166 05-18)

The concept of factory-to-pad testing is based on the shipment of a flight ready spacecraft to the launch base. Operations at the launch base would then be limited to external interface checks with the booster, support systems and range, propellant/ pneumatic/ordnance systems servicing and status verification. This approach is achieved by thorough, comprehensive factory testing of the spacecraft. Launch base operations, normally requiring several months, would be completed in about two weeks. Major cost savings and increased test effectiveness could be realized. Author

**N76-14173*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**EVALUATION PHILOSOPHY FOR SHUTTLE LAUNCHED PAYLOADS**
R. E. Heuser *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 8 p (For availability see N76-14166 05-18)

Potential benefits of factory-to-pad testing constitute major cost savings and increase test effectiveness. Overall flight performance will be improved. The factory-to-pad approach is compatible with space shuttle processing and the large space telescope program. Author

**N76-14174** Aerospace Corp., El Segundo, Calif.
**IN PROCESS AND ACCEPTANCE TESTING OF DIGITAL COMPUTERS**
A. J. Osborn *In its* Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 11 p (For availability see N76-14166 05-18)

The need and effectiveness of in-process design, development and testing of high reliability computers involved in booster guidance applications are outlined. Abbreviated descriptions of a computer and environmental test methods are included together with a discussion of problem failures and test results. Author

**N76-14175** Fairchild Industries, Inc., Farmingdale, N.Y.
**PERFORMANCE VERIFICATION OF ATS-6 HEAT PIPES**
Robert Eby *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 14 p (For availability see N76-14166 05-18)

The heat pipe testing program for the ATS-6 satellite consists of several developmental tasks, extensive testing of individual pipes, tests of honeycomb panels containing heat pipes, accelerated life tests and finally an all-up thermal balance orbital simulation test. Life test data on 25 heat pipes found the majority stable with respect to gas generation. The corresponding rates of gas generation are such that the thermal control subsystem would not be adversely affected for the life of a two year mission. Author

**N76-14176** TRW Systems, Redondo Beach, Calif.
**PYROTECHNIC SHOCK TRANSMISSION IN COMPONENT VERSUS S/C TESTING**
H. N. Luhrs *In* Inst. of Environ Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 20 p (For availability see N76-14166 05-18)

Two different pyrotechnic shock test techniques are to be compared, namely the use of a vibration table to simulate the shock, and the use of actual pyrotechnics on a spacecraft. This comparison is to be made by using an instrumented dynamic model tested by both techniques. Shock measurements were made inside a dynamic model of a component while being tested by both techniques. The results are compared on the basis of both peak g's as well as spectrums. Author

**N76-14177*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**PYROTECHNIC SHOCK MEASUREMENT AND DATA ANALYSIS REQUIREMENTS**
Lee Albers *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 22 p refs (For availability see N76-14166 05-18)
(Contract NAS7-100)

An investigation is described into the laboratory measurement and analysis of pyrotechnic shock which was prompted at JPL when two separate facilities generated discrepant pyrotechnic shock data while testing Mariner Jupiter/Saturn 1977 spacecraft hardware. Both of the testing facilities were surveyed. The only difference noted was in the FM tape recorders used to record the data. One facility used a tape recorder operating at 60 in./sec with a frequency response of 20 kHz; the other used a tape recorder operating at 120 in./sec with a frequency response of 80 kHz. The accelerometers, cables, charge amplifiers, and mechanical setups were identical. Author

**N76-14178** Aerospace Corp., El Segundo, Calif.
**COMPONENT ACCEPTANCE TEST EVALUATION FOR ONE USAF SATELLITE PROGRAM**
M. C. Shrader *In its* Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 10 p (For availability see N76-14166 05-18)

An improved satellite testing program is developed to improve early on-orbit failure rates. Prolonged random vibration-, thermal vacuum- and temperature cycling-tests decreased workmanship/ part failure percentages at the component and satellite levels of the test. G.G.

**N76-14179** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**ACOUSTIC CHAMBER EFFICIENCY FACTOR AND COMPONENT RANDOM VIBRATION SPECIFICATIONS**
A. Ikola and D. Retzloff *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 14 p (For availability see N76-14166 05-18)

An extensive data search was conducted of all available published data on acoustic chamber efficiency effects for acoustic reverberation test chambers. Although the available data were somewhat limited, enough information was assembled from a variety of space vehicle and reverberation chamber configurations to permit some positive conclusions to be formed. On project P-XX, where the possibility of overexposure during ground testing was faced as a result of increased test levels, studies were conducted to permit better understanding and use of chamber efficiency factors. It is recommended that the aerospace industry in general consider chamber efficiency factors in the development of test programs. Author

**N76-14180*** Philco-Ford Corp., Philadelphia, Pa.
**SYNCHRONOUS METEOROLOGICAL SATELLITE SPIN TESTING**
D. J. McBrady *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 14 p refs (For availability see N76-14166 05-18)
(Contract NAS5-21575)

The objective of the end-to-end spin test is to demonstrate both qualitatively and quantitatively that the satellite performs its intended functions under spinning conditions. The test is performed twice per satellite, once during the baseline functional test prior to environmental testing, and once during the final functional test. All satellite functions are demonstrated during the spin test with the exception of solar panel illumination, pyrotechnic device operation, VISSR infrared operation, and auxiliary propulsion system operation. Author

**N76-14181** Hughes Aircraft Co., Culver City, Calif.
**PHOTOMETRIC TECHNIQUE FOR DETERMINING SOLAR FLUX INCIDENT UPON SPACECRAFT SURFACES**
W. A. Hagemeyer *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 10 p refs (For availability see N76-14166 05-18)

A photometric mapping technique is reported for obtaining thermal design information on satellite antenna beams by determining local solar irradiation accurately and at low cost. The method uses models geometrically and reflectively similar to the prototype of interest, and a collimated radiant field for simulating sunlight. A remote radiation detector with a narrow field of view measures total reflected energy from the target. Total solar flux is obtained as the ratio of readings at model locations to those at the reference position. G.G.

**N76-14182** Hughes Aircraft Co., Culver City, Calif.
**SINE VIBRATION TESTS OF A LARGE COMMUNICATION SATELLITE**
Y. Weisman and R. J. Zuziak *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 15 p (For availability see N76-14166 05-18)

A sinusoidal testing method for spacecraft structures is described that uses multiple notch control rationale and intra-test inspection for vibrational qualification. As many as seven positions of response sensors are used to control shaker inputs. Pre- and post-dynamic structural responses obtained from low energy random input are compared for their dynamic structural signatures. G.G.

**N76-14183*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**DIGITAL CONTROL OF HIGH-INTENSITY ACOUSTIC TESTING**
Ronald A. Slusser *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 17 p (For availability see N76-14166 05-18)
(Contract NAS7-100)

A high intensity acoustic test system is reported that consists of a reverberation room measuring 18 feet wide by 21 feet long by 26 feet high, with an internal volume of 10,900 cubic feet. The room is rectangular in shape. Acoustic energy is supplied through two 50-Hz cutoff exponential horns about 12 feet long. Each of the two horns has two transducers rated at 4000 acoustic watts each. A gaseous nitrogen supply is used to supply the energy. The equalized electrical signal is corrected by a circuit designed to compensate for the transducer nonlinearity, then fed into one channel of a phase linear power amplifier, then into the transducer. The amplifiers have been modified to increase their reliability. The acoustic energy in the room is monitored by six B and K 1/2-inch condenser microphones. The electrical signal from each microphone is fed into a six channel real time averager to give a spatial average of the signals. Author

**N76-14184** Lockheed Missiles and Space Co., Sunnyvale, Calif.
**AATCS: AN AUTOMATED TEST CONTROL SYSTEM**
R. J. Lyon *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 16 p (For availability see N76-14166 05-18)

A computerized test control system for acceptance testing of various complex electronic and electro-mechanical devices is reported. The system is intended to expand pre-test specimen modeling and simulation, and to increase data handling capabilities of the real time data acquisition and control program. AATCS hardware is composed of two general purpose computers, some special logic devices and a set of peripheral interfaces. The software which operates the system prepares for the test, actively performs the test, and manipulates after test data. G.G.

**N76-14185*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**AUTOMATIC COMPUTER CONTROLLED TESTING OF SPACECRAFT AND EXPERIMENTS**
W. D. Blakeslee *In* Inst. of Environ. Sci. Proc. of 2d Aerospace Testing Seminar 18 Mar. 1975 12 p (For availability see N76-14166 05-18)

Autotest is a flexible, fully automatic, programmable test system. It is externally controlled by a mnemonic test language. Once started, tests can run to completion without further manual intervention. Autotest can be operated manually as well as in automatic mode. Autotest can be adapted to a wide variety of test requirements. Though originally designed to test the Atmosphere Explorer (AE) spacecraft and experiments, autotest can easily be modified to test any electronic device suitable for automated computer testing. Author

**N76-14186*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**SPACECRAFT DOCKING AND ALIGNMENT SYSTEM Patent**
Donald C. Cheatham and Richard Reid, inventors (to NASA) Issued 7 Oct. 1975 6 p Filed 15 Jun. 1973 Supersedes N73-26879 (11 - 17, p 2086)
(NASA-Case-MSC-12559-1; US-Patent-3,910,533; US-Patent-Appl-SN-370582; US-Patent-Class-244-161; US-Patent-Class-33-286; US-Patent-Class-35-12; US-Patent-Class-178-DIG.20; US-Patent-Class-356-153) Avail: US Patent Office CSCL 22B

A spacecraft docking alignment system is provided utilizing a three-dimensional target and screen mounted along the docking axis of one spacecraft and a television camera installed along the docking axis of the other spacecraft. A television display, with attendant electronics, is provided in the other spacecraft for viewing the relative alignment of the two spacecraft by the astronaut in control of the docking maneuver. Both spacecraft may be equipped with target, screen, camera, and display such that either spacecraft may control the docking maneuver.
Official Gazette of the U.S. Patent Office

**N76-14187*#** Martin Marietta Corp., Denver, Colo.
**POSITIVE ISOLATION DISCONNECT Final Report**
Arthur A. Rosener and Thomas G. Jonkoniec Dec. 1975 181 p
(Contract NAS9-14376)
(NASA-CR-144634; MCR-75-365) Avail: NTIS HC $7.50 CSCL 22B

A positive isolation disconnect was developed for component replacement in serviced liquid and gaseous spacecraft systems. Initially a survey of feasible concepts was made to determine the optimum method for fluid isolation, sealing techniques, coupling concepts, and foolproofing techniques. The top concepts were then further evaluated, including the fabrication of a semifunctional model. After all tradeoff analyses were made, a final configuration was designed and fabricated for development testing. This resulted in a 6.35 mm (1/4 inch) line and 12.7 mm (1/2 inch) line positive isolation disconnect, each unit consisting of two coupled disconnect halves, each capable of fluid isolation with essentially zero clearance between them for zero leakage upon disconnect half disengagement. An interlocking foolproofing technique was incorporated that prevents uncoupling of disconnect halves prior to fluid isolation. Author

**N76-14188#** Aerospace Corp., El Segundo, Calif.
**A CONCEPT OF DESPIN MECHANICAL ASSEMBLY LIFE TESTING INVOLVING TOTAL CHARACTERIZATION Interim Report**
Seymour Feuerstein and Arthur S. Forster 29 Jul. 1975 31 p refs
(Contract F04701-75-C-0076)
(AD-A013721; TR-0076(6270-30)-3; SAMSO-TR-75-203) Avail: NTIS CSCL 22/2

The critical requirements placed on the performance and life of moving mechanical assemblies in spacecraft demand the ultimate in reliability. Confidence levels must be established by testing units over time intervals that are significantly shorter than their intended application life. A concept of total mechanical assembly life testing through comprehensive instrumentation for

early detection of system degradation is presented. Testing criteria and appropriate measurement techniques are discussed. On the basis of this approach, an advanced technology test program was initiated in 1972. GRA

# 19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

**N76-14189*#** RCA Labs., Princeton, N.J.
**DESIGN, PROCESSING, AND TESTING OF LSI ARRAYS FOR SPACE STATION Quarterly Technical Report, 1 Jul. - 30 Sep. 1975**
A. C. Ipri Nov. 1975 12 p
(Contract NAS12-2207)
(NASA-CR-144113; PRRL-75-CR-62; QTR-18) Avail: NTIS HC $3.50 CSCL 22B

The Si-gate CMOS/SOS process used to manufacture integrated circuits is examined. A process analysis test structure is developed to determine the defect mechanisms most detrimental to yield, control, and reliability. Author

# 20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

**N76-14190*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**CONTROLLED SEPARATION COMBUSTOR Patent**
Albert J. Juhasz and Richard W. Niedzwiecki, inventors (to NASA) Issued 7 Oct. 1975 5 p Filed 24 May 1973 Supersedes N73-25816 (11 - 16, p 1955)
(NASA-Case-LEW-11593-1; US-Patent-3,910,035; US-Patent-Appl-SN-363691; US-Patent-Class-60-39.23; US-Patent-Class-60-39.29; US-Patent-Class-60-39.74R) Avail: US Patent Office CSCL 21H

A short annular combustor utilizing diffuser bleed to control the airflow distribution in a gas turbine engine at various operating conditions is described. Official Gazette of the U.S. Patent Office

**N76-14191*** National Aefonautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ROCKET CHAMBER AND METHOD OF MAKING Patent**
Anthony Fortini, inventor (to NASA) Issued 7 Oct. 1975 4 p Filed 24 Jan. 1974 Supersedes N74-28232 (12 - 17, p 2084)
(NASA-Case-LEW-11118-2; US-Patent-3,910,039; US-Patent-Appl-SN-436316; US-Patent-Class-60-265; US-Patent-Class-60-267; US-Patent-Class-239-127.3) Avail: US Patent Office CSCL 21H

A transpiration cooled rocket chamber is made by forming a porous metal wall on a suitably shaped mandrel. The porous wall may be made of sintered powdered metal, metal fibers sintered on the mandrel, or wires woven onto the mandrel and then sintered to bond the interfaces of the wires. Intersecting annular and longitudinal ribs are then electroformed on the porous wall. An interchamber wall having orifices is then electroformed over the annular and longitudinal ribs. Parallel longitudinal ribs are then formed on the outside surface of the interchamber wall after which an annular jacket is electroformed over the parallel ribs to form distribution passages. A feed manifold communicating with the distribution passages may be fabricated and welded to the rocket chamber or the feed manifold may be electroformed in place. Official Gazette of the U.S. Patent Office

**N76-14192*#** Textron, Inc., Buffalo, N.Y.
**SPACE SHUTTLE ORBIT MANEUVERING ENGINE REUSABLE THRUST CHAMBER PROGRAM Final Report**
John M. Senneff May 1975 384 p refs
(Contract NAS9-12803)
(NASA-CR-144632; BAC-8693-950001) Avail: NTIS HC $10.75 CSCL 21H

Reusable thrust chamber and injector concepts were evaluated for the space shuttle orbit maneuvering engine (OME). Parametric engine calculations were carried out by computer program for $N_2O_4$/amine, LOX/amine and LOX/hydrocarbon propellant combinations for engines incorporating regenerative cooled and insulated columbium thrust chambers. The calculation methods are described including the fuel vortex film cooling method of combustion gas temperature control, and performance prediction. A method of acceptance of a regeneratively cooled heat rejection reduction using a silicone oil additive was also demonstrated by heated tube heat transfer testing. Regeneratively cooled thrust chamber operation was also demonstrated where the injector was characterized for the OME application with a channel wall regenerative thrust chamber. Bomb stability testing of the demonstration chambers/injectors demonstrated recovery for the nominal design of acoustic cavities. Cavity geometry changes were also evaluated to assess their damping margin. Performance and combustion stability was demonstrated of the originally developed 10 inch diameter combustion pattern operating in an 8 inch diameter thrust chamber. Author

**N76-14193*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**COMPARATIVE ASSESSMENT OF OUT-OF-CORE NUCLEAR THERMIONIC POWER SYSTEMS**
W. C. Estabrook, D. R. Koenig (LASL), and W. Z. Prickett (GE) 15 Nov. 1975 94 p refs
(Contract NAS7-100)
(NASA-CR-145972; JPL-TM-33-749) Avail: NTIS HC $5.00 CSCL 21C

The hardware selections available for fabrication of a nuclear electric propulsion stage for planetary exploration were explored. The investigation was centered around a heat-pipe-cooled, fast-spectrum nuclear reactor for an out-of-core power conversion system with sufficient detail for comparison with the in-core system studies completed previously. A survey of competing power conversion systems still indicated that the modular reliability of thermionic converters makes them the desirable choice to provide the 240-kWe end-of-life power for at least 20,000 full power hours. The electrical energy will be used to operate a number of mercury ion bombardment thrusters with a specific impulse in the range of about 4,000-5,000 seconds. Author

**N76-14194*#** Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
**THE 15 CM MERCURY ION THRUSTER RESEARCH 1975 Report, 1 Dec. 1974 - 1 Dec. 1975**
Paul J. Wilbur Dec. 1975 120 p refs
(Grant NGR-06-002-112)
(NASA-CR-134905) Avail: NTIS HC $5.50 CSCL 21C

Doubly charged ion current measurements in the beam of a SERT II thruster are shown to introduce corrections which bring its calculated thrust into close agreement with that measured during flight testing. A theoretical model of doubly charged ion production and loss in mercury electron bombardment thrusters is discussed and is shown to yield doubly-to-singly charged ion density ratios that agree with experimental measurements obtained on a 15 cm diameter thruster over a range of operating conditions. Single cusp magnetic field thruster operation is discussed and measured ion beam profiles, performance data, doubly charged ion densities, and discharge plasma characteristics are presented for a range of operating conditions and thruster geometries. Variations in the characteristics of this thruster are compared to those observed in the divergent field thruster and the cusped field thruster is shown to yield flatter ion beam profiles at about the same discharge power and propellant utilization operating point. An ion optics test program is described and the measured effects of grid system dimensions on ion beamlet half angle and diameter are examined. The effectiveness of hollow cathode startup using a thermionically emitting filament within the cathode is examined over a range of mercury flow rates and compared to results obtained with a high voltage tickler startup

technique. Results of cathode plasma property measurement tests conducted within the cathode are presented. Author

**N76-14195#** Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
**BAND MODEL COMPUTER PROGRAM FOR THE CALCULATION OF INFRARED RADIATION FROM ROCKET EXHAUST PLUMES CONTAINING HCl AND HF**
Joseph H. Scanlon and Michael W. Slack Dec. 1975 28 p refs
(RM-607) Avail: NTIS HC $4.00

The Grumman fine spectral resolution (FSR) computer program for the calculation of infrared radiation emitted by rocket exhaust plumes is modified to include the radiation from HCl and HF. The resulting program predicts the infrared emission from plumes containing H2O, Co2, CO, HCl, and HF gases, and fine carbon particles as radiating species. The Single Line Group band model, employing a modified Curtis-Godson approximation, is used to represent the radiative heat transfer. Computations are performed with varying wavenumber intervals of 5, 10, or 25/cm, which are determined by available band model data. Sample spectra between 2 and 5 microns are presented for idealized exhaust plumes of two rocket engines, one a solid propellant and the other burning ClF3/N2H4. The FSR predicted radiant intensitites for HCl and HF are compared to laboratory measurements. Author

**N76-14196*#** TRW Systems Group, Redondo Beach, Calif.
**DESIGN OF MULTI-MISSION CHEMICAL PROPULSION MODULES FOR PLANETARY ORBITERS. VOLUME 1: SUMMARY REPORT**
15 Aug. 1975 88 p refs 3 Vol.
(Contract NAS2-8370)
(NASA-CR-137789; TRW-26085-6001-TU-00-Vol-1) Avail: NTIS HC $5.00 CSCL 21H

Results are presented of a conceptual design and feasibility study of chemical propulsion stages that can serve as modular propulsion units, with little or no modification, on a variety of planetary orbit missions, including orbiters of Mercury, Saturn, and Uranus. Planetary spacecraft of existing design or currently under development, viz., spacecraft of the Pioneer and Mariner families, are assumed as payload vehicles. Thus, operating requirements of spin-stabilized and 3-axis stabilized spacecraft have to be met by the respective propulsion module designs. As launch vehicle for these missions the Shuttle orbiter and interplanetary injection stage, or Tug, plus solid-propellant kick motor was assumed. Accommodation constraints and interfaces involving the payloads and the launch vehicle are considered in the propulsion module design. The applicability and performance advantages were evaluated of the space-storable high-energy bipropellants. The incentive for using this advanced propulsion technology on planetary missions is the much greater performance potential when orbit insertion velocities in excess of 4 km/sec are required, as in the Mercury orbiter. Design analyses and performance tradeoffs regarding earth-storable versus space-storable propulsion systems are included. Cost and development schedules of multi-mission versus custom-designed propulsion modules are examined. Author

**N76-14197*#** TRW Systems Group, Redondo Beach, Calif.
**DESIGN OF MULTI-MISSION CHEMICAL PROPULSION MODULES FOR PLANETARY ORBITERS. VOLUME 2: TECHNICAL REPORT**
15 Aug. 1975 270 p refs 3 Vol.
(Contract NAS2-8370)
(NASA-CR-137790; TRW-26085-6001-TU-00-Vol-2) Avail: NTIS HC $9.00 CSCL 21H
For abstract, see N76-14196.

**N76-14198*#** TRW Systems Group, Redondo Beach, Calif.
**DESIGN OF MULTI-MISSION CHEMICAL PROPULSION MODULES FOR PLANETARY ORBITERS. VOLUME 3: APPENDIXES**
15 Aug. 1975 135 p refs 3 Vol.
(Contract NAS2-8370)
(NASA-CR-137791; TRW-26085-6001-TU-00-Vol-3) Avail: NTIS HC $6.00 CSCL 21H
For abstract, see N76-14196.

**N76-14199#** Maryland Univ., College Park. Dept. of Aerospace Engineering.
**NONEQUILIBRIUM EFFECTS IN KEROSENE-OXYGEN ROCKET NOZZLE FLOWS**
John S. Vamos and John D. Anderson, Jr. Jun. 1975 32 p refs
(Grant AF-AFOSR-2575-74; AF Proj. 6813; AF Proj. 9750)
(AD-A013845; AE-75-4; AFOSR-75-1189TR) Avail: NTIS CSCL 21/2

Nonequilibrium flow calculations were made for a small rocket engine burning kerosene and oxygen. Such rockets can be used in the laboratory for producing plumes under controlled experimental conditions. A time-dependent finite-difference technique was used to calculate the chemical nonequilibrium flow throughout the nozzle, including nonequilibrium conditions both upstream and downstream of the nozzle throat. Cases were computed for oxidizer/fuel ratios from 1.6 to 5. The results indicated that the principal chemical species (CO2, H2O and CO) deviated from equilibrium by about 20% at the nozzle exit. Of particular importance is the nonequilibrium gas static temperature, which is approximately 400K less than equilibrium conditions. GRA

**N76-14200#** Aerospace Corp., El Segundo, Calif. Vehicle Engineering Div.
**AN ANALYTICAL MODEL FOR A TWO-PHASE VACUUM PLUME Final Report**
B. E. Pearce 30 Jun. 1975 41 p refs
(Contract F04701-74-C-0075)
(AD-A013738; TR-0075(5901-01)-5; SAMSO-TR-75-204) Avail: NTIS CSCL 21/2

A simple analytical model is proposed that specifies the gas and particle mass, momentum, and kinetic energy fluxes in a two-phase vacuum plume from a solid propellant rocket motor. The objective is to provide a description of the undisturbed plume structure for use in plume impingement assessments. Analytical expressions for the angular and radial dependence of the gas and particle flows are chosen based on a comparison with two-phase method-of-characteristics solutions and a spherical source flow model for plumes at large distances (more than 10 exit radii) from the nozzle exit. The model accurately predicts the gas mass flux but overpredicts the gas momentum flux. Both the particle mass and momentum flux are underpredicted by from 12 to 33 percent in the cases examined. A comparison with other approximate models for two-phase plumes suggests the model described herein offers improved accuracy and a more realistic specification of the spatial structure of both the gaseous and particle plumes. GRA

## 23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

**N76-14201#** Naval Research Lab., Washington, D.C.
**REPORT OF NRL PROGRESS**
Mar. 1975 70 p refs
(PB-243214/4) Avail: NTIS HC $4.50; Also available on subscription $40.00/year domestic, $50.00/year foreign CSCL 05B

A progress report covering: attenuated-total-reflection studies of surface plasmons on semiconductors, progress notes-acoustics, ceramics, digital applications, electronics technology, fracture mechanics, material sciences, metallurgy, optical materials, space science, space systems; papers by NRL staff members; patents; and reader service is presented. GRA

## 24 COMPOSITE MATERIALS

Includes laminates.

**N76-14202** Massachusetts Univ., Amherst.
**TRANSIENT HEAT TRANSFER IN LAMINATED COMPOSITES: AN EXPERIMENTAL STUDY Ph.D. Thesis**

Vanhuy Truong 1975 182 p
Avail: Univ. Microfilms Order No. 75-27557

Two questions are discussed: under what conditions is it appropriate to use an equivalent thermal diffusivity which is the ratio of the effective thermal conductivity and average heat capacity of two materials which form the composite; and when use of the conventional equivalent thermal diffusivity is not appropriate, what method could be used for calculating transient thermal response in composites. Two values of thermal diffusivities were calculated from the information of phase shift and amplitude decrement at different cross-sections as a periodic thermal wave propagated in a laminated material parallel to the interfaces. A study of the dimensionless parameters which describe the thermal system shows that alpha sub A for high thermal conductivity ratios or thermal diffusivity ratios depends strongly on the ratios of thermal conductivities or thermal diffusivities and volume fraction of the two materials. Expressions which include these two dimensionless parameters were correlated from the results of the experimental investigation using aluminum/PMMA, brass/PMMA and steel/PMMA composites of different volume fractions. Dissert. Abstr.

**N76-14203*** National Aeronautics and Space Administration. Pasadena Office, Calif.
**PREVENTION OF HYDROGEN EMBRITTLEMENT OF HIGH STRENGTH STEEL BY HYDRAZINE COMPOSITIONS Patent**
Leonard Weber, inventor (to NASA) (McDonnell-Douglas Corp., Santa Monica, Calif.) Issued 11 Nov. 1975 10 p Filed 28 Sep. 1973 Supersedes N74-20397 (12 - 11, p 1338) Sponsored by NASA
(NASA-Case-NPO-12122-1; US-Patent-3,919,014;
US-Patent-Appl-SN-401921; US-Patent-Class-149-36;
US-Patent-Class-423-407) Avail: US Patent Office CSCL 11D

Delayed failure of high strength steel alloys exposed to compositions containing hydrazine is prevented by addition of potassium hydroxide to the composition in an amount at least sufficient to neutralize acidic impurities. The removal of the acidic impurities eliminates evolution of hydrogen and thus avoids hydrogen embrittlement of the high strength steel alloys.
Official Gazette of the U.S. Patent Office

**N76-14204*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**RECONSTITUTED ASBESTOS MATRIX Patent**
Hoyt McBryar, inventor (to NASA) Issued 7 Oct. 1975 6 p Filed 22 Jan. 1973 Supersedes N73-16577 (11 - 07, p 0811)
(NASA-Case-MSC-12568-1; US-Patent-3,910,814;
US-Patent-Appl-SN-325784; US-Patent-Class-162-102;
US-Patent-Class-136-146; US-Patent-Class-136-148;
US-Patent-Class-162-153; US-Patent-Class-162-222;
US-Patent-Class-162-228) Avail: US Patent Office CSCL 11D

An asbestos matrix suitable for use in a fuel cell or electrolysis cell is produced. The cell has a greater porosity and bubble pressure for a given thickness, improved homogeneity, and more uniform thickness. The matrix is produced by first shredding the asbestos, forming a slurry of the asbestos with water or a low boiling hydrocarbon, preferably an alcohol such as methanol, forming a mat by passing the slurry through a properly sized porous plaque with a piece of filter paper on top, drying the mat, and rolling the mat to yield desired thickness and surface finish. Official Gazette of the U.S. Patent Office

**N76-14205*#** Scientific Translation Service, Santa Barbara, Calif.
**TECHNICAL AND ECONOMICAL CONSIDERATIONS ON THE USE OF SELF-SUPPORTING PLASTIC SANDWICH CONSTRUCTIONS IN ELECTRICAL VEHICLES**
Hans George Raschbichler Washington NASA Dec. 1975 15 p Transl. into ENGLISH from Elektrotech. Z. Ausg. A (Berlin), v. 94, no. 11, Nov. 1973 p 679-682
(Contract NASw-2791)
(NASA-TT-F-16824) Avail: NTIS HC $3.50 CSCL 11D

The development of a new type of electrical transport vehicle is described with a floor module using self supporting plastic sandwich construction methods (GFK/PUR sandwich = glass fiber reinforced plastic/polyurethane sandwich). The advantages of this plastic technology with respect to the vehicle concept and the economy of the vehicle are discussed. Details of special production methods and the economy of production are elaborated. Author

**N76-14206#** Washington Univ., St. Louis, Mo. Materials Research Lab.
**FAILURE CRITERIA TO FRACTURE MODE ANALYSIS OF COMPOSITE LAMINATES**
Edward M. Wu 1975 14 p refs
(Grant AF-AFOSR-2687-74; AF Proj. 6813; AF Proj. 9782)
(AD-A013884; AFOSR-75-1065TR) Avail: NTIS CSCL 11/4

Quantitative understanding of the parameters which control composite fracture is imperative to the implementation of fail safe design and inspection of critical load bearing structures. For isotropic materials, fracture is essentially controlled by a single parameter, e.g., the fracture toughness or the stress-intensity factor. This one dimensional nature lends itself to experimental quantification. However, for anisotropic composites there are at least seven primary controlling parameters: (1) crack length; (2) crack orientation with respect to material axis of anisotropy; (3) nature of applied combined stresses; (4) lamination geometry; (5) deformational and strength responses of the constitutent lamina; (6) three kinematically admissible modes of crack extension and (7) crack trajectory. Because of this large number of parameters, experimental quantification by systematic permutation of the parameters must be realistically viewed as intractable. This paper presents an analytical method of reducing these parameters from seven to two and furnishes experimental observations which lend support to the theoretical model. GRA

**N76-14207#** United Technologies Research Center, East Hartford, Conn.
**DIRECTIONALLY SOLIDIFIED IN-SITU EUTECTIC CERAMIC MATRIX-METAL COMPOSITES Final Report, 15 Feb. 1974 - 15 Mar. 1975**
Charles O. Hulse 15 Mar. 1975 74 p refs
(Contract N00019-74-C-0271)
(AD-A013602; UTRC/R75-911842-4) Avail: NTIS CSCL 11/4

The objective of this work was to identify and develop directionally solidified ceramic matrix-metal eutectic composites for use uncoated at temperatures of 2400 F and preferably higher in aircraft gas turbines. The primary approach was to discover metal-oxygen systems in which the metal whisker phase would form a self-protective oxide coating on exposure to elevated temperatures. Many different metal-oxygen combinations were melted and examined mostly using prefired slugs held in tungsten wire baskets which were heated by radiation inside a carbon susceptor in argon. Practically all compositions could be directionally solidified successfully inside CVD tungsten tubes partially sealed at their ends. Additives which provided additional oxygen to the melt such as CeO2, Cr2O3 and WO3 were often necessary to increase the metal solubility sufficiently to form a eutectic microstructure. A number of potentially interesting systems, Gd2O3-CeO2-Ta, Y2O3-CeO2-Ta, and Y2O3-CeO2-Y, could not survive a 24 hr exposure to air at 2000 F. The Cr-Al2O3, Cr2O3 system, however, showed a surface attack of only a few mils after an exposure of 60 hrs in air at 2600 F. Author (GRA)

**N76-14208#** Naval Postgraduate School, Monterey, Calif.
**STRESS CONCENTRATION IN FIBROUS COMPOSITE MATERIAL M.S. Thesis**
Carlos Roberto Santos Alves Jun. 1975 65 p refs
(AD-A013609) Avail: NTIS CSCL 11/4

This thesis work involves an initial study on Stress Concentration caused by holes out of center in thin plates of finite width made of Unidirectional and Crossply Fiberglass Composites. The results are reported under the form of two nondimensional parameters, one representing the eccentricity of the holes, and the other representing the influence of the size of the holes. The graphs plotted for concentration factors permit their use for thin plates of different dimensions. Author (GRA)

**N76-14209#** Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.

**DYNAMIC BEHAVIOR OF IDEAL FIBRE-REINFORCED RIGID-PLASTIC BEAMS**
Norman Jones Jun. 1975 39 p refs
(Contract N00014-67-A-0204-0032)
(AD-A014056; OE-75-10) Avail: NTIS CSCL 11/4

Theoretical solutions are developed herein for the dynamic plastic structural response of some ideal fibre-reinforced beams with boundary conditions and external dynamic loadings which can be reproduced easily and reliably in a laboratory. The theoretical behavior of these beams is also compared to the corresponding dynamic response of rigid perfectly plastic isotropic beams. Generally speaking, it appears that the permanent transverse deflections and response durations of ideal fibre-reinforced beams loaded dynamically are less than the corresponding values for similar rigid perfectly plastic isotropic beams. GRA

# 25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

**N76-14210** Washington Univ., Seattle.
**FIBER SURFACE PROPERTIES IN RELATION TO BONDING Ph.D. Thesis**
Jaakko Einari Laine 1974 184 p
Avail: Univ. Microfilms Order No. 75-28379

It has been shown that the retention of polyethyleneimine (PEI) by polyethylene terephthalate (polyester) fibers in aqueous polyelectrolyte solutions as a consequence of the pH change is caused by the increase in the hydrodynamic volume of PEI which is thereby entrapped inside the containing pore. The effects of the pertinent variables of the entrapment process have been studied, as well as the usefulness of this treatment in securing ionic bonding of small molecules from their aqueous solutions onto the fiber surface. The employment of the entrapment concept in promotion of nonwoven adhesion was also studied. The results, however, were not encouraging apparently due to the low concentration of PEI on the fiber surface. Consequently, more numerous ionic sites as afforded by a hydrolytic cleavage of the ester bonds in the polyester fiber surface did indicate a spectacular increase in breaking length of the composite when reinforced with a cationic natural polymer, chitosan. Dissert. Abstr.

**N76-14211** British Library Lending Div., Boston Spa (England).
**THE USE OF COMPLEXONES FOR CHEMICAL CLEANING OF THERMAL POWER ENGINEERING EQUIPMENT**
T. Kh. Margulova Jul. 1975 57 p Trans. into ENGLISH of the book "Primenenie Kompleksonov v Teploenergetiki" Moscow, 1973 p 107-161
(BLL-RTS-9980) Avail: British Library Lending Div., Boston Spa, Engl.: £10.00; 16 BLL photocopy coupons

The requirements that apply to chemical cleaning are discussed along with the advantages of blends containing complexones, selection of cleaning parameters, corrosive action of washing solutions, and the cleaning of boilers before start-up. M.J.S.

**N76-14212*#** Colorado State Univ., Fort Collins.
**COMBUSTION INSTABILITY WITH PARTIAL LENGTH ACOUSTIC LINERS Research Report, 31 Dec. 1974 - 31 Dec. 1975**
C. E. Mitchell, M. R. Baer, and Y. Jotiban Dec. 1975 7 p refs
(Grant NGR-06-002-095)
(NASA-CR-145976) Avail: NTIS HC $3.50 CSCL 12B

The development is discussed of analytical techniques and numerical methods for the prediction of the stability behavior of liquid propellant rocket combustors with partial length acoustic liners, injector face baffles, and nonlinear combustion responses. Three primary objectives included: (1) extension of the Green's Function integral-iteration technique previously developed so that nonlinear three dimensional wave propagation effects could be included in stability predictions; (2) development of an analytical technique and a computer program for the prediction of the damping effects caused by injector face baffles; and (3) inclusion of a nonlinear, wave distortation dependent, combustion response model in the global stability analysis and determination of its effect on combustor stability. Author

**N76-14213*#** Kanner (Leo) Associates, Redwood City, Calif.
**THE COMBUSTION PROCESS IN POWDERED COAL FIRING**
W. Nusselt Washington NASA Dec. 1975 27 p refs Transl. into ENGLISH from Z. Verein Deutscher Ingr. (West Ger.), v. 68, 1924 p 124-128
(Contract NASw-2790)
(NASA-TT-F-16801) Avail: NTIS HC $4.00 CSCL 21B

The process of combustion is discussed in terms of ignition temperature and actual burning of the particle. It is shown that the ignition temperatures of solid fuels are below those of mixtures of combustible gases which ignite spontaneously between 500 deg and 600 deg. Other topics discussed include: relation of ignition temperature to temperature of furnace wall and size; relation of time elapsing before ignition of particle to ignition temperature, wall temperature of furnace, and size of particle; and relation of the time for combustion to size of particle. Author

**N76-14214*#** Scientific Translation Service, Santa Barbara, Calif.
**CONCENTRATION PROFILES IN FRONT OF A CARBON SURFACE BURNING IN A FLOW OF OXYGEN. 2: CALCULATION OF THE CONCENTRATION PROFILES**
P. Hugo, E. Wicke, and G. Wurzbacher Washington NASA Dec. 1975 27 p refs Transl. into ENGLISH of "Konzentrationsprofile vor einer im Sauerstoffstrom verbrennenden Kohlenstoffoberflache. Berechnung der Konzentrationsprofile" Submitted for publication
(Contract NASw-2483)
(NASA-TT-F-16814) Avail: NTIS HC $4.00 CSCL 21B

The interpretation of the experimental results of carbon combustion are presented. In calculating the concentration distributions, the general balances were first developed, assuming a stagnant diffusional boundary layer. The homogeneous combustion of CO was taken into consideration by means of a first-order rate expression with respect to the concentration of CO. By means of suitable simplifications, approximate solutions were derived from the general equations. These provided an insight into the relationship between the different processes which influence the concentration distribution: (1) the conversion of carbon at the wall, (2) the homogeneous combustion of CO, and (3) mass transfer by means of diffusion in the boundary layer. Author

**N76-14215*#** Transemantics, Inc., Washington, D.C.
**DETERMINING THE CONCENTRATION OF ALCOHOL AND ETHER VAPORS IN EXHAUST ALCOHOL-ETHER MIXTURES WITH THE AID OF A ZEISS GAS INTERFEROMETER**
Ya. A. Schneydman and I. P. Demochko Washington NASA Dec. 1975 8 p Transl. into ENGLISH from Zavod. Lab. (USSR), v. 8, 1939 p 519-520
(Contract NASw-2792)
(NASA-TT-F-16682) Avail: NTIS HC $3.50 CSCL 07C

The use of a gas interferometer in determining the concentration of alcohol and ether vapors was described. Special emphasis was placed on proper prior calibration of the instrument with respect to the alcohol fraction; a calibration curve was obtained and is illustrated. The additivity characteristics of the instrument are explained and examples are given. Author

**N76-14216*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SAMPLE PREPARATION OF METAL ALLOYS BY ELECTRIC DISCHARGE MACHINING**
Gilbert B. Chapman, II and William A. Gordon Washington Jan. 1976 22 p refs
(NASA-TM-X-3328; E-8438) Avail: NTIS HC $3.50 CSCL 07D

Electric discharge machining was investigated as a noncontaminating method of comminuting alloys for subsequent chemical

analysis. Particulate dispersions in water were produced from bulk alloys at a rate of about 5 mg/min by using a commercially available machining instrument. The utility of this approach was demonstrated by results obtained when acidified dispersions were substituted for true acid solutions in an established spectrochemical method. The analysis results were not significantly different for the two sample forms. Particle size measurements and preliminary results from other spectrochemical methods which require direct aspiration of liquid into flame or plasma sources are reported. Author

**N76-14217#** Cornell Univ., Ithaca, N.Y. School of Mechanical and Aerospace Engineering.

**VIBRATIONAL RELAXATION IN HYDROGEN-CARBON MONOXIDE AND DEUTERIUM-CARBON MONOXIDE MIXTURES, MEASURED VIA STIMULATED RAMAN-IR FLUORESCENCE Interim Report**

H. Matsui, E. L. Resler, Jr., and S. H. Bauer 1975 28 p refs (Grant AF-AFOSR-2744-74; AF Proj. 6813; AF Proj. 9781) (AD-A012693; AFOSR-75-0942TR) Avail: NTIS CSCL 07/4

Rate constants for vibration-vibration and vibration-translation energy transfers were measured by exciting the hydrogenic spaces in a stimulated raman cavity and recording the subsequent rise and decay of IR fluorescence from the admixed CO at 4.7 micrometers. Under the justifiable assumption that the intraspecies redistribution of vibrational energy is very rapid, the time variation of fluorescence intensities and their dependence on the sample composition can be accounted for. GRA

**N76-14218#** Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

**ELECTRONICALLY EXCITED METAL ATOMS PRODUCED BY CHEMICAL REACTIONS Final Report, 1 Jan. 1974 - 30 Jun. 1975**

J. L. Hirschfield 1975 10 p (Grant AF-AFOSR-2637-74; AF Proj. 9538) (AD-A013818; AFOSR-75-1169TR) Avail: NTIS CSCL 07/4

The report briefly describes research on two types of highly exoergic chemical reactions. These reactions are reactions of metal dimers with halogen atoms and reaction of carbon atoms with metal oxides. Experiments were completed on the reaction of thallium with fluorine. Chemiluminescence was observed both from thallium atoms and electronically excited TlF molecules. Preliminary experiments were also started on the reaction of carbon with metal oxide. GRA

**N76-14219#** Geoscience, Inc., Cambridge, Mass. Dept. of Chemistry.

**TRANSITION METAL AND LANTHANIDE COMPOUNDS Final Report, 1 Jan. 1971 - 30 Jun. 1975**

R. B. King Jun. 1975 33 p refs (Grant AF-AFOSR-2000-71) (AD-A013817; AFOSR-75-1170TR) Avail: NTIS CSCL 07/2

Research results in the following areas are described: (1) the synthesis of polyphosphines and their metal complexes including polyphosphines with terminal methyl and neopentyl groups; (2) reactions of polypyrazolylborates with the metal complexes C5H5Co(CO)(R sub f)I (R sub f = perfluoroalkyl group), C3F7Fe(CO)4I, (CH3)3PtI)4, and C3H5Fe(CO)3I; (3) reactions of cyclopentadienyl and allyl molybdenum derivatives with alkyl isocyanides; (4) redox chemistry of hexamethylbenzene niobium and tantalum derivatives; and (5) lanthanide nitrate complexes of certain macrocyclic polyethers and the use of macrocyclic polyether columns for lanthanide separations. This basic chemistry is potentially important for applications such as antioxidants in lubricating fluids, fuel cell additives, superconductor materials, and laser materials. Author (GRA)

**N76-14220#** Flow Research, Inc., Kent, Wash.

**REACTIONS AND ELECTROCHEMICAL KINETICS OF NEWLY-GENERATED METAL SURFACES Final Scientific Report, 1 May 1972 - 30 Jun. 1975**

Theodore R. Beck Jul. 1975 22 p refs (Contract F44620-72-C-0070; AF Proj. 9536) (AD-A013843; AFOSR-75-1074TR) Avail: NTIS CSCL 07/4

Air Force flight vehicles must withstand increasingly complex environmental and operational regimes. Fundamental knowledge of the mechanisms of fatigue and fracture of flight structures is required. This research is related to the understanding of crack propagation, stress corrosion and corrosion fatigue in titanium and other metals. An electrochemical mass transport kinetic (MTK) model was previously formulated by the author to quantitatively describe the electrochemical events in a crack. The research described was done to fulfill the requirement of the model for quantitative data on new titanium surfaces and to develop a general understanding of the kinetics of the repassivation process. GRA

**N76-14221#** Army Foreign Science and Technology Center, Charlottesville, Va.

**KINETIC OF THERMAL DISSOCIATION OF HYDRAZINE NITRATE**

Yu. I. Rubtsov and G. B. Manelis 27 Mar. 1975 14 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (USSR), v. 44, no. 2, 1970 p 396-400 (AD-A014049; FSTC-HT-23-0617-75) Avail: NTIS CSCL 07/4

On a micro-calorimeter in intervals of 194-254C the kinetic reaction of thermal dissociation of hydrazine nitrate has been investigated. The reaction accelerates whereupon the amount of acceleration depends upon m/V. The kinetic parameters of the reaction have been found. It has been demonstrated that the reaction proceeds across the equilibrium dissociation of hydrazine nitrate to hydrazine and nitric acid whereupon with the main reaction there appears catalytical dissociation of hydrazine in the liquid phase. GRA

**N76-14222#** National Bureau of Standards, Washington, D.C. Center for Fire Research.

**A SMALL-SCALE ENCLOSURE FOR CHARACTERIZING THE FIRE BUILDUP POTENTIAL OF A ROOM Final Report**

W. J. Parker and B. T. Lee Jun. 1975 24 p refs Sponsored in part by Naval Sea Systems Command, Washington, D.C. (COM-75-11030/4; NBSIR-75-710) Avail: NTIS HC $3.50 CSCL 13L

An enclosure with a high ceiling was used to model some fires in a burnout room. Temperatures, oxygen concentrations, air velocity, and conductive and radiative heat fluxes were measured. The highest average air temperature in the upper part of the room was taken as a measure of the fire buildup potential of the room. Upper air temperatures attained in the model were similar in most cases to those in the full-scale compartment. From energy balance considerations this air temperature was related to the oxygen depletion in the room and was shown to correlate well with the oxygen content of the combustion gas and air exhausting from the model and full-scale room fires. GRA

**N76-14223#** National Academy of Sciences - National Research Council, Washington, D.C. Office of Chemistry and Chemical Technology.

**THE PROPOSED NATIONAL RESOURCE FOR COMPUTATION IN CHEMISTRY: A USER-ORIENTED FACILITY**

Jun. 1975 60 p refs (Contract NSF C-310) (PB-243812/5) Avail: NTIS HC $4.50 CSCL 07A

The detailed planning of the organizational structure, management, scientific policy, facilities, site selection criteria, and funding of a national computational center designed to serve chemistry and related sciences is described. A questionnaire sent to proposed host institutions and to potential users is included along with a summary of their responses. GRA

**N76-14224#** Naval Ordnance Lab., White Oak, Md.

**COMPUTED AND EXPERIMENTAL HUGONIOTS FOR UNREACTED POROUS HIGH EXPLOSIVES Final Report**

John O. Erkman and David J. Edwards 31 Dec. 1974 80 p refs (ZR0130901) (AD-A013642; NOLTR-74-213) Avail: NTIS CSCL 19/4

A knowledge of the Hugoniot of unreacted explosives is required to interpret transitional phenomena in explosives and to determine the shock sensitivity of explosives. The usual method employed to obtain the Hugoniot of a material is to perform a series of experiments which measure two of the following variables: shock velocity, particle velocity, pressure, and volume.

However, there are drawbacks to this approach for porous (granular) explosives. Fortunately, computational methods have been developed which yield the Hugoniot of inert, porous materials when the Hugoniot of the non-porous material is known. If these computational methods can be applied to porous explosives, much work and expense can be saved. In this study, the authors have applied these computational methods to porous TNT for a range of densities from 1.60 to 0.98 g/cc. This method was confirmed by experimentally obtaining the Hugoniot for unreacted TNT at a density of 0.98 g/cc over the range of particle velocities of 0.350 - 1.720 mm/microsec and of pressures of 3.6 - 55.0 kbar. GRA

**N76-14225#** Naval Surface Weapons Center, White Oak, Md.
**SPONTANEOUSLY COMBUSTIBLE SOLIDS, A LITERATURE SURVEY Final Report, Apr. - Oct. 1974**
Eleonore G. Kayser and Carl Boyars May 1975 35 p refs
(Contract DOT-AS-40049)
(PB-244046/9; DOT-TES-20-75-1) Avail: NTIS HC$4.00 CSCL 07D

Existing information on spontaneously combustible solids including pyrophoric-air hazardous materials and water reactive materials was reviewed. Pertinent data on (1) the causes and prevention of spontaneous combustion in organic and inorganic materials due to air and water reactivity, (2) the application of various mathematical treatments to spontaneously combustible materials, and (3) available test methods for assessing the flammable properties of spontaneously combustible materials, e.g., autoignition temperature and spontaneous heating are also included. GRA

**N76-14226#** Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
**INVESTIGATION OF CENTRIFUGAL FORCE AND REYNOLDS NUMBER EFFECTS ON COMBUSTION PROCESSES Final Report, Jun. 1973 - Jun. 1975**
George D. Lewis and Clifford E. Smith Jun. 1975 86 p refs
(Contract F44620-73-C-0061; AF Proj. 9711)
(AD-A013912; PWA-FR-6996; AFOSR-75-1167TR) Avail: NTIS CSCL 21/2

Tests in a combustion centrifuge have demonstrated that increased buoyancy produced by centrifugal force can be used to increase flamespeeds significantly over turbulent flamespeed, which controls combustion rates in conventional burners. A model has been developed that predicts the flamespreading rate at various burner conditions. In addition, a second model, based on classical heat transfer correlations, has been developed to predict with reasonable accuracy the extinction limits of flames at very high centrifugal force values. The effects of Reynolds number on turbulent flamespeeds and on limiting bubble sizes in gravitational fields have also been measured. Testing of a subscale swirl augmentor has confirmed the validity of the experimental model and it has been used to design a full-scale augmentor for advanced versions of an Air Force turbofan engine. The swirl augmentor is predicted to reduce the fuel consumption and increase the stability of the engine. GRA

**N76-14227#** Army Foreign Science and Technology Center, Charlottesville, Va.
**THE MECHANISM OF CATALYZER ACTION ON THE BURNING OF CONDENSED SYSTEMS**
O. P. Korobeinichev, A. M. Viktorenko, and A. G. Tereshchenko 30 Apr. 1975 15 p refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (USSR), v. 8, 1972 p 511-517
(AD-A014046; FSTC-HT-23-0148-75) Avail: NTIS CSCL 21/2

A considerable number of works have been devoted to a study of the catalysis mechanism in the burning of condensed mixtures on the base of ammonium perchlorate (AP). There is no single point of view on this question. The data of some authors confirm the gas-phase mechanism for the action of the catalyst while experiments indicate that the place of action of the catalyst is the condensed phase. The theory of the strongest possible catalyst in the gas phase predicts the strong dependence of the catalyst's effectiveness on its dispersion. This work is devoted to an experimental study of the mechanism of the catalyst's action on the burning of condensed systems on the base of AP. GRA

**N76-14228#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**EXPERIMENTAL STUDY METHOD OF THE COMBUSTION OF A SPINNING METALLIZED SOLID PROPELLANT**
B. Doin, J. Brulard, and P. Larue 15 Jul. 1975 77 p refs Transl. into ENGLISH from Rech. Aeron. (France), no. 229, 1974 p 1-38
(AD-A013974; FTD-ID(RS)I-1543-75) Avail: NTIS CSCL 21/2

Description and capabilities of the set-ups developed for studying experimentally, from microscopic scale to full engine size, the influence of rotation on the combustion of a metallized solid propellant. Small scale tests on samples make possible the determination of a critical value for the diameter of aluminum droplets, at which the combustion kinetics of the metal remain unchanged. Tests 'rings' make possible the quantitative characterization of the propellant sensitivity to acceleration. GRA

**N76-14229#** Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
**NO2 COMBUSTOR EMISSIONS INVESTIGATION Final Technical Report, Oct. 1973 - Feb. 1975**
Dennis E. Walsh May 1975 70 p refs
(AF Proj. 3066)
(AD-A013933; AFAPL-TR-75-46) Avail: NTIS CSCL 21/2

This report presents the results of an experimental program investigating the possibility of NO2 formation within the burners of aircraft gas turbine engines. An environment resembling the cooler regions of the combustor (e.g., the cooling layer) was established to test a proposed mechanism involving: (1) transport of NO from a 'hot' combustor section into a region more thermodynamically favorable for NO2 formation, e.g., the cooling layer, and (2) subsequent reaction of the NO to form NO2 either homogeneously or under the influence of catalysis (heterogeneous or homogeneous). Results of experiments conducted examining this possibility revealed that under the action of hydrocarbons, significant amounts of NO can be oxidated to NO2. The role of Drierite on NO2 adsorption was also investigated. An unverified explanation of this phenomenon is presented involving reaction of NO2 and H2O to HNO3 and NO. GRA

# 26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

**N76-14230** State Univ. of New York, Stony Brook.
**HYDROGEN INDUCED INTERNAL CRACKING OF IRON Ph.D. Thesis**
Barry Jay Berkowitz 1975 112 p
Avail: Univ. Microfilms Order No. 75-29150

Armco iron (99.5+%) was hydrogenated electrochemically in an acid solution in the absence of applied stress resulting in the formation of voids, blisters and internal cracks. The voids and cracks appear to be transgranular and formed by a ductile mode of deformation. Subsequent mechanical testing reveals that both yielding behavior and ductility are greatly affected and well correlated with the void volume. Samples which were aged at room temperature after hydrogenation exhibit a partial recovery in ductility which could only be attributed to plastic relaxation, since the hydrogen content, as measured by an outgassing technique, shows no decrease during this period. The results of this investigation indicate that at initial stages of charging, hydrogen enters the lattice and collects at microvoids and other trapping sites, causing no damage. The voids begin to grow when the local stress concentrations exceed the yield strength of the iron. Void growth ceases when the work-hardened iron can no longer accommodate plastic strain. Dissert. Abstr.

**N76-14231** British Library Lending Div., Boston Spa (England).
**INFLUENCE OF HIGHER He CONTENTS (400-500ppm) ON THE MECHANICAL PROPERTIES OF HASTELLOY-X AT HIGH TEMPERATURES**
H. Bohm and C. Wassilew [1974] 7 p refs Transl. into ENGLISH from the German report

(BLL-CE-Trans-6712-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The influence was examined of high He contents on the mechanical properties of heat resistant alloys at high temperatures. Irradiated samples of Hastelloy-X were subjected to tensile and time-to-rupture tests. Experimental and calculated values of He concentration were found to be in agreement. Experimental results are presented and discussed. J.M.S.

**N76-14232** British Library Lending Div., Boston Spa (England).
**HELIUM ANALYSIS IN 1.4988, 1.4981, AND 1.4970 STEELS AFTER IRRADIATION IN THE BR2 REACTOR**
K. D. Closs [1974] 6 p refs Transl. into ENGLISH from Atomwirtschaft (Duesseldorf), v. 19, 1974 p 134-135
(BLL-CE-Trans-6713-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Helium analysis of irradiated samples of austenitic steels is described. Helium formed as a result of (n, alpha)-reactions is calculated taking into account the chemical composition of the steels, the neutron flux spectrum of the BR2, and the cross-sections for the reactions. Measured and calculated helium concentrations are compared and are found to be in agreement. J.M.S.

**N76-14233** Georgia Inst. of Tech., Atlanta.
**THE RELATIONSHIP OF MICROSTRUCTURE TO MONOTONIC AND CYCLIC STRAINING IN TWO ALUMINUM-ZINC-MAGNESIUM PRECIPITATION HARDENING ALLOYS Ph.D. Thesis**
Thomas Henry B. Sanders, Jr. 1975 135 p
Avail: Univ. Microfilms Order No. 75-26216

The effect of microstructure on the monotonic and low cycle fatigue properties of a high purity, large grain, ternary aluminum-zinc-magnesium (Al-Zn-Mg) alloy and a high strength 7050 aluminum alloy was investigated. The number of steps in the precipitation sequency was unaltered by the presence of copper in the 7050 alloy. Copper and aluminum were thought to enter directly into the zone formation. The conclusion that copper and aluminum were present in the zones was justified on the basis of the electron:atom stability of the Friauf-Laves $MgZn_2$ structure. The presence of copper in the alloys increased the Guinier Preston solvus temperature, presumably by a reduction in the barrier to nucleation. Dissert. Abstr.

**N76-14234** Ohio State Univ., Columbus.
**HYDROGEN-INDUCED FRACTURE IN ULTRAHIGH-STRENGTH STEELS Ph.D. Thesis**
David Clinton Langstaff 1975 259 p
Avail: Univ. Microfilms Order No. 75-26608

The feasibility of studying the susceptibility of ultrahigh-strength steel wires to HIDF was determined using a simple qualitative test. The experimental variables were defined as clearly as possible to minimize spurious results. An incubation period study indicated that the embrittling effect due to hydrogen was reversible during the incubation period prior to crack initiation. A low apparent diffusivity of hydrogen was also observed during the incubation tests. SEM examination of the specimen fracture surface indicated that all the fracture surface was formed by microvoid coalescence. The susceptibility to HIDF is attributed to the interaction of the effects of hydrogen on void nucleation and growth, the dispersion and size of active void nuclei, and the normal resistance to crack propagation in the material. Dissert. Abstr.

**N76-14235** Michigan Univ., Ann Arbor.
**A STUDY OF STRAIN INDUCED MARTENSITE IN METASTABLE AUSTENITIC MANGANESE STEELS Ph.D. Thesis**
Frantisek Borik 1975 124 p
Avail: Univ. Microfilms Order No. 75-29181

Stress-strain curves of several austenitic manganese steels of varying mechanical stability were determined from uniaxial tension tests conducted at room temperature. The steels contained 0.68 to 1.13% carbon, 3.02 to 5.80% manganese, and 0 to 1.02% molybdenum. In the tests, some steels transformed partially to strain induced martensite. The characteristic changes in the shape of the stress-strain curves, imposed by the transformation, were analyzed using a parametric equation. In general, the effects of alloying, as determined from the solution of the proposed parametric equation, were found to be in harmony with the arguments of solution strengthening and the stacking fault energy, as well as pertinent observations reported in the literature. The equation also gave a reasonable estimate of the amount of strain induced martensite in the structure which was corroborated by magnetic and metallographic measurements. Dissert. Abstr.

**N76-14236** Ohio State Univ., Columbus.
**THE DEVELOPMENT OF A NEW HIGH STRENGTH COBALT-BASE ALLOY Ph.D. Thesis**
Darryl John Costin 1975 76 p
Avail: Univ. Microfilms Order No. 75-26562

The metallurgical principles involved and the theoretical considerations utilized in the development of a new cobalt-superalloy, Alloy B, used as hardware for the production of glass fibers are discussed. The structural features, and the mechanical and chemical properties of the alloy are characterized. Alloy B exhibits exceptional elevated temperature stress-rupture strength, low minimum creep rate, improved glass corrosion resistance, and outstanding castability. The results of plant trials in six different manufacturing plants with Alloy B in-house produced spinners are given. The plant trials demonstrated that Alloy B can significantly extend the average spinner life and virtually eliminate spinner stress-rupture failures. Of even greater significance, the Plant 2 trials revealed that Alloy B spinners can fiberize higher melting point, lower cost, glasses and yet double the average corporate-side spinner life of Alloy A spinners. Dissert. Abstr.

**N76-14237** North Carolina Univ., Chapel Hill.
**STRUCTURAL CHEMISTRY OF MAGNETICALLY CONDENSED COPPER(2) COMPLEXES Ph.D. Thesis**
Eva Dixon Estes 1975 200 p
Avail: Univ. Microfilms Order No. 75-29020

The crystal and molecular structures of several copper(II) complexes were investigated in an attempt to correlate their structural features with their magnetic properties. The following structures were determined from three dimensional X-ray data collected on a Picker automatic four-circle diffractometer: di-mu-hydroxo-bis-(N,N,N',N'-tetraethyl ethylene- diamine) dicopper(II) perchlorate; chloro(2-diethyl aminoethanolato)copper (II); bromo(2-dibutyl aminoethanolato)copper(II); bis(dichloro(N,N, N',N'-tetramethyl ethylenediamine)copper(II); and dichloro(N,N,N', N'-tetraethyl ethylenediamine)copper(II). The magnetic properties of tetraaquobis(mu-hippurato-O)-bis(hippurato-O)dicopper(II) were determined and discussed in light of the known structure. The crystal structure of tetramethyl ammonium pentakis-(trichlorogermanyl)platinate(II) is also reported. Program notes and listings for computer programs MELVYN, THESIS, and PLANE are included. Dissert. Abstr.

**N76-14238** Michigan Univ., Ann Arbor.
**HEAT CAPACITIES OF MANGANESE, COBALT, NICKEL AND ZINC TUNGSTATES Ph.D. Thesis**
Christopher Paul Landee 1975 182 p
Avail: Univ. Microfilms Order No. 75-29272

Heat capacities of manganese and nickel tungstate ($MnWO_4$ and $NiWO_4$) were measured over the temperature range 5 to 350 K while the heat capacities of cobalt and zinc tungstate ($CoWO_4$ and $ZnWO_4$) were measured from 5 to 550 K by means of adiabatic calorimetry. The low-temperature anomaly in the heat capacity of manganese tungstate, associated with the antiferromagnetic transition, was bifurcated with the two maxima appearing at (12.57 + or - 0.05) K and (13.36 + or - 0.05) K. A small peak also appeared at (6.80 + or - 0.1) K. The temperatures of maximum heat capacities for the antiferromagnetic anomalies in cobalt and nickel tungstates were (47.7 + or - 0.1) K and (59.80 + or - 0.05) K. The excess entropies associated with the antiferromagnetic anomalies were estimated for the manganese tungstate, cobalt tungstate, and nickel tungstate by means of calculations which used the heat capacity of zinc tungstate to estimate the lattice contributions to the total heat capacities of the respective compounds. Thermal functions for all tungstates were calculated from the experimental data by means of curve fitting and integration. Dissert. Abstr.

**N76-14239** British Library Lending Div., Boston Spa (England).
**THE OPTICAL AND ELECTRICAL BEHAVIOUR OF METALS BASED ON MEASUREMENTS ON VERY THIN LAYERS**

**PRODUCED BY EVAPORATION**
Werner Flechsig [1975] 43 p refs Transl. into ENGLISH from Z. Phys., (West Germany), v. 176, 1963 p 380-398 In ENGLISH and GERMAN
(BLL-M-23787-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 5 BLL photocopy coupons

The contribution to the absorption theory of electrical conductivity is discussed with special reference to the behavior of thin metal layers. In small dimension bodies consisting of a substance having free charge carriers, the normal path lengths of the carriers are reduced. The optical properties of the substance are affected by this. To predict the magnitude and form of the changes produced, a simplified calculation was made for the appropriate components of the complex dielectric constant, which can serve as a basis for a comparison with measurements on very thin layers of monovalent noble metals. Author

**N76-14240*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**HIGH GAS VELOCITY OXIDATION AND HOT CORROSION TESTING OF OXIDE DISPERSION-STRENGTHENED NICKEL-BASE ALLOYS**
Daniel L. Deadmore and Carl E. Lowell Nov. 1975 29 p refs
(NASA-TM-X-71835; E-8544) Avail: NTIS HC $4.00 CSCL 11F

Several oxide dispersion strengthened (ODS) nickel-base alloys were tested in high velocity gases for cyclic oxidation resistance at temperatures to 1200 C and times to 500 hours and for hot corrosion resistance at 900 C for 200 hours. Nickel-chromium-aluminum ODS alloys were found to have superior resistance to oxidation and hot corrosion when compared to bare and coated nickel-chromium ODS alloys. The best of the alloys tested had compositions of nickel - 15.5 to 16 weight percent chromium with aluminum weight percents between 4.5 and 5.0. All of the nickel-chromium-aluminum ODS materials experienced small weight losses (less than 16 mg/sq cm). Author

**N76-14241*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**MOSSBAUER EFFECT IN DILUTE IRON ALLOYS**
Jag J. Singh 17 Dec. 1975 35 p refs
(NASA-TM-X-72810) Avail: NTIS HC $4.00 CSCL 11F

The effects of variable concentration, x, of Aluminum, Germanium, and Lanthanum atoms in Iron lattice on various Mossbauer parameters was studied. Dilute binary alloys of (Fe-Al), (Fe-Ge), (Fe-Al) containing up to x = 2 a/o of the dilute constituent were prepared in the form of ingots and rolled to a thickness of 0.001 in. Mossbauer spectra of these targets were then studied in transmission geometry to measure changes in the hyperfine field, peak widths isomer shifts as well as the ratio of the intensities of peaks (1,6) to the intensities of peaks (2,5). It was shown that the concept of effective hyperfine structure field in very dilute alloys provides a useful means of studying the effects of progressively increasing the solute concentration on host lattice properties. Author

**N76-14242*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**AN INVESTIGATION OF FRACTURE TOUGHNESS, FATIGUE-CRACK GROWTH, SUSTAINED-LOAD FLAW GROWTH, AND IMPACT PROPERTIES OF THREE PRESSURE VESSEL STEELS**
C. Michael Hudson, J. C. Newman, Jr., and Peter E. Lewis Washington Dec. 1975 54 p refs
(NASA-TM-X-3316; L-10447) Avail: NTIS HC $4.50 CSCL 11F

The elastic fracture toughness of the three steels is shown to not decrease significantly with decreasing temperature from room temperature to about 244 K (-20 F.). The elastic fracture toughness of the three steels increased with increasing specimen width and thickness. The fatigue-crack-growth data for all three steels fall into relatively narrow scatter bands on plots of rate against stress-intensity range. An equation is shown to predict the upper bounds of the scatter bands reasonably well. Charpy impact energies decreased with decreasing temperature in the nominal temperature range from room temperature to 244 K (-20 F). The nil-ductility temperatures of the steels are discussed. Author

**N76-14243*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ANALYSIS OF RADIALLY CRACKED RING SEGMENTS SUBJECT TO FORCES AND COUPLES**
Bernard Gross and John E. Strawley [1975] 26 p refs Proposed for presentation at Comm. E-24 Symp. on Develop. in Fracture Mech. Tests, St. Louis, 2-7 May 1976; sponsored by the Am. Soc. for Testing and Mater.
(NASA-TM-X-71842) Avail: NTIS HC $4.00 CSCL 11F

Results of planar boundary collocation analysis are given for ring segment (C shaped) specimens with radial cracks, subjected to combined forces and couples. Mode I stress intensity factors and crack mouth opening displacements were determined for ratios of outer to inner radius in the range 1.1 to 2.5, and ratios of crack length to segment width in the range 0.1 to 0.8. Author

**N76-14244*#** Kanner (Leo) Associates, Redwood City, Calif.
**THE ADSORPTION OF CARBON MONOXIDE ON COPPER FILMS OF VARIOUS THICKNESS**
H. G. Kock Washington NASA Jan. 1976 56 p refs Transl. into ENGLISH of "Die Adsorption von Kohlenmonoxid an Kupferfilmen unterschiedlicher Schichtdicke", 1967 71 p
(Contract NASw-2790)
(NASA-TT-F-16825) Avail: NTIS HC $4.50 CSCL 11F

Copper films ranging in thickness from 70 A to 650 A were vapor deposited in ultrahigh vacuum. The electronic properties of the pure films were determined from measurements of electrical resistance and photoelectric effect. The dependence of the resistance on film thickness and the mean free electron path were measured. Carbon monoxide layers superimposed on the copper films were studied for effects on resistance, output potential, and mass constant. The photoelectric behavior and the adsorption isotherms were measured and characterized by means of a model. Author

**N76-14245*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EFFECT OF NATURE OF OXYGEN INTERACTIONS ON FRICTION OF TITANIUM, ALUMINUM, AND MOLYBDENUM**
Donald H. Buckley Washington Jan. 1976 17 p refs
(NASA-TN-D-8123; E-8386) Avail: NTIS HC $3.50 CSCL 11F

Friction studies were conducted with a gold pin contacting titanium, aluminum, and molybdenum surfaces after exposure to oxygen with various methods. Oxygen was adsorbed on the surface, it reacted with the surface, and the surface was ion bombarded with oxygen. The presence of oxygen was monitored with Auger spectroscopy. Titanium friction varied with the mode of the metal-oxygen interaction. It was highest with the adsorbed oxygen and least with ion bombardment using oxygen. Aluminum exhibited lower friction values for the reacted and the ion bombarded surfaces than for the surface having the adsorbed layer. With molybdenum the friction coefficients were generally the same despite the nature of the surface treatment with oxygen. Author

**N76-14246*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EFFECTS OF CARBON AND HAFNIUM CONCENTRATIONS IN WROUGHT POWDER-METALLURGY SUPERALLOYS BASED ON NASA 2B-11 ALLOY**
Robert V. Miner, Jr. Washington Jan. 1976 36 p refs
(NASA-TN-D-8113; E-8468) Avail: NTIS HC $4.00 CSCL 11F

A candidate alloy for advanced-temperature turbine engine disks, and four modifications of that alloy with various C and Hf concentrations were produced as cross-rolled disks from prealloyed powder that was hot isostatically compacted. The mechanical properties, microstructures, and phase relations of the alloys are discussed in terms of their C and Hf concentrations. A low-C and high-Hf modification of IIB-11 had the best balance of mechanical properties for service below about 750 C. Because of their finer grain sizes, none of the powder-metallurgy alloys produced had the high-temperature rupture strength of conventionally cast and wrought IIB-11. Author

**N76-14247*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**NICKEL BASE ALLOY Patent Application**
John C. Freche and William J. Waters, inventors (to NASA) Filed 30 Dec. 1975 9 p
(NASA-Case-LEW-12270-1; US-Patent-Appl-SN-645507) Avail: NTIS HC $3.50 CSCL 11F

A nickel base superalloy for use at temperatures of 2000 F (1095 C) to 2200 F (1205 C) as a stator vane material in advanced gas turbine engines is described. The alloy has a nominal composition in weight percent of 16 tungsten, 7 aluminum, 1 molybdenum, 2 columbium, 0.3 zirconium, 0.2 carbon and the balance nickel. NASA

**N76-14248#** American Univ., Washington, D.C. Dept. of Chemistry.
**STRESS CORROSION CRACKING CONTROL MEASURES. 4: ALUMINUM ALLOYS**
B. F. Brown Jun. 1975 40 p refs
(Contract N00014-68-A-0247-0007; NR Proj. 036-103)
(AD-A013611) Avail: NTIS CSCL 11/6

The most prevalent form of SCC service failures in aluminum alloys is caused by a combination of water, aqueous solutions or atmospheric moisture, alloy of susceptible composition and structure, and sustained tensile stresses, most often caused by heat treatment or assembly. The principal practical measures to control SCC are: (1) select an alloy of minimum susceptibility; (2) for wrought alloy, take precautions not to impose high sustained stresses across the short transverse grain direction unless the alloy and temper confer low susceptibility; (3) keep water and water vapor from the metal surface by providing natural drainage and by painting, with an inhibitor such as chromate; (4) minimize opportunities for chlorides to concentrate; (5) when using a susceptible alloy and temper, compressively stress the metal surface by peening or rolling, followed by painting; (6) use cathodic protection; (7) do not permit mercury or its compounds in close proximity to any aluminum structure. GRA

**N76-14249#** American Univ., Washington, D.C. Dept. of Chemistry.
**STRESS CORROSION CRACKING CONTROL MEASURES. 5: TITANIUM ALLOYS**
B. F. Brown Jun. 1975 25 p refs
(Contract N00014-68-A-0245-0007; NR Proj. 036-103)
(AD-A013612) Avail: NTIS CSCL 11/6

The practical SCC hazards to titanium involve a wide range of environments. For some groups of environments, such as natural waters and nearly neutral aqueous solutions, the cracking occurs only in the presence of a pre-existing crack-like flaw, and fracture mechanics type tests readily characterize the SCC behavior of alloys. Unalloyed titanium and the widely used Ti-6%al-4%V alloy are reasonably resistant to SCC in these environments. For N2O4 and red fuming nitric acid, practical control of the problem is available through controlling the composition of the oxidizers, for which standard specifications are available. For the hot salt cracking problem during heat treatment, meticulous cleanliness of the titanium, backed up preferably by excluding moisture and oxygen from the heat treating atmosphere, serves to control the problem. Though untried in practice, a nickel barrier paint may be useful when contamination at elevated temperatures cannot be avoided in service; the alternative is to design for low operating stresses. For some environments, such as methanol, mercury, cadmium or silver, the strategy is to exclude them from titanium surfaces. GRA

**N76-14250#** Frankford Arsenal, Philadelphia, Pa.
**CORRELATION DETERMINATIONS BETWEEN STRESS CORROSION CHARACTERISTICS OF WROUGHT 7039 ALUMINUM ARMOR AND OTHER ALLOY CHARACTERISTICS: BALLISTIC PERFORMANCE, YIELD STRENGTH, AND ELECTRICAL CONDUCTIVITY**
James V. Rinnovatore, Donald T. Rorabaugh, and Albert Zalcmann Apr. 1975 31 p ref
(DA Proj. 1G6-62601-AH-71)
(AD-A013981; FA-TR-75026) Avail: NTIS CSCL 19/4

The study was performed to determine whether a correlation could be established between the stress corrosion resistance of wrought 7039-T6 aluminum armor plates and other alloy characteristics such as ballistic performance, yield strength, and electrical conductivity. A survey and statistical analysis were conducted on acceptance test data available for about 500 preproduction lots of 7039-T6 plates. GRA

**N76-14251#** North Carolina Univ., Chapel Hill. Dept. of Materials Engineering.
**A MECHANISTIC MODEL FOR PREDICTION OF DUCTILE EROSION Final Report, 1 Jan. - 31 Dec. 1974**
William H. Jennings, Charles R. Manning, Jr., and William J. Head Jul. 1975 70 p refs
(Contract DAAJ02-73-C-0028; DA Proj. 1F1-62203-A-119)
(AD-A013833; USAAMRDL-TR-75-30) Avail: NTIS CSCL 11/6

Mechanisms operative in dust erosion of ductile materials were determined with the aid of scanning electron microscope studies. Dimensional analysis was employed in the development of a mathematical model for predicting erosion of ductile materials. The basis of the model was the predominant identified erosion mechanism, target melting. The model was verified in an erosion testing program. Target materials in the testing program were three stainless steels, two aluminum alloys, a beryllium-copper alloy, and a titanium alloy. Erosive agents were three dusts comprised of hard, angular particles and one dust with spherical particles. Maximum particle velocities were 130 or 250 meters per second. Author (GRA)

**N76-14252#** Naval Research Lab., Washington, D.C.
**A FRACTURE MECHANICS AND FRACTOGRAPHIC STUDY OF FATIGUE CRACK PROPAGATION RESISTANCE IN 17-4 PH STAINLESS STEELS Final Report**
T. W. Crooker, D. F. Hasson, and G. R. Yoder 21 May 1975 24 p refs
(NRL Proj. M01-24; RR0220146)
(AD-A013591; NRL-7910) Avail: NTIS CSCL 11/6

A determination of fatigue-crack propagation resistance in heat-treated samples of 17-4 PH stainless steel was made together with correlative microscopic observations via electron fractography. Two rolled plates of 1/2 in. thickness were investigated: one vacuum melted and heat treated to the H1050 condition, and the other argon-oxygen melted and heat treated to the H1050 and H1150 conditions. Crack growth rates were obtained in ambient laboratory air as a function of stress-intensity factor range delta k using single-edge notched tension specimens. The effect of stress ratio on crack growth rate was examined; microscopic modes of crack propagation determined by electron fractography were used to explain differences in macroscopic crack growth behavior. It was found that the heat treatment can be adjusted to minimize the incidence of cleavage, and that slight variation in alloy processing serves to eliminate cleavage and promote striation formation, while enhancing the fracture toughness. Author

**N76-14253#** Naval Research Lab., Washington, D.C.
**FRACTURE TOUGHNESS OF LIGHT-WATER REACTOR PRESSURE-VESSEL MATERIALS Quarterly Progress Report, period ending 31 Oct. 1974**
F. J. Loss, J. R. Hawthorne, and C. A. Griffis Jan. 1975 19 p refs
(Contract AT(49-25)-1003; NRL Proj. M01-40)
(AD-A004625; NRL-MR-2972) Avail: NTIS CSCL 11/6

The dynamic fracture toughness of three heats of nuclear pressure vessel materials is characterized. Techniques are developed for the interpretation and analysis of notched, three-point bend beams under impact loading. GRA

**N76-14254#** Naval Postgraduate School, Monterey, Calif.
**CHARACTERIZING AND CONTROLLING THE METALLURGICAL PROPERTIES OF A CuMn ALLOY FOR SHIP SILENCING APPLICATIONS M.S. Thesis**
Frederick Lee Youngblood Jun. 1975 90 p refs
(AD-A013657) Avail: NTIS CSCL 11/6

Electrical resistivity measurements were used to investigate the effect of stress, applied during aging and quenching, on the specific damping capacity (SDC) of Incramute (a 40 Mn - 58 Cu - 2 Al commercial alloy). It was found that (1) stress applied during either aging, or quenching reduces the SDC of the alloy, (2) the martensitic transformation temperature is a linear function

of the stress applied during quenching, and (3) stress applied during the aging treatment retards the aging kinetics. The hystersis of the martensite transformation, and the Neel temperature were determined from resistivity-temperature data. A phenomenological model based on SDC, percent of the martensitic transformation, and applied stress was developed to describe and predict the alloy's SDC behavior under various heat treatment schemes and stress conditions. Author (GRA)

**N76-14255#** Clemson Univ., S.C.
**EXPLORATORY DEVELOPMENT ON OXIDATION BEHAVIOR OF TITANIUM ALLOYS UNDER HIGH HEATING RATES Final Report, 1 May 1973 - 31 Oct. 1974**
James S. Wolf Apr. 1975 393 p refs
(Contract F33615-73-C-5151; ARPA Order 2387; AF Proj. 2387)
(AD-A013880; AFML-TR-74-265) Avail: NTIS CSCL 11/6

The initial stages of reaction of unalloyed titanium, Ti-6Al-4V, Ti8Mn, and beta-III titanium alloy specimens with oxygen, nitrogen and atmospheres bearing these gases has been studied over the temperature range from 800 to 1300C. The kinetics of these reactions were analyzed for specimens subjected to linear heating rates in the range from 0.5 to 100C/s. Mathematical techniques were devised for modeling: (1) the oxygen uptake by unalloyed titanium during heating, and (2) the deposition of the chemical heat of reaction into oxidizing substrates. GRA

**N76-14256#** Battelle Columbus Labs., Ohio.
**DETERMINATION OF SELECTED MIL-HDBK-5 DESIGN ALLOWABLE PROPERTIES FOR FIVE AEROSPACE MATERIALS Annual Technical Report, 15 Feb. 1974 - 15 Feb. 1975**
Paul E. Ruff May 1975 189 p refs
(Contract F33615-73-C-5053; AF Proj. 7381)
(AD-A013877; AFML-TR-75-58) Avail: NTIS CSCL 11/6

This annual report describes a test program to develop certain missing MIL-HDBK-5 design allowable properties for five aerospace materials: 2024-T861 aluminum alloy sheet, 17-4PH and 15-5PH precipitation hardening stainless steel bar, 9Ni-4Co-0.20C. steel plate, and Ti-6Al-6V-2Sn annealed extrusion. Design allowable properties were determined in accordance with MIL-HDBK-5 guidelines. Mechanical properties determined were tensile yield strength tensile ultimate strength; compressive yield strength; shear ultimate strength; bearing yield strength; bearing ultimate strength; compressive modulus of elasticity; Poisson's ratio; stress-strain curves; stress-tangent modulus curves, and high temperature properties. GRA

**N76-14257#** Bureau of Mines, College Park, Md. Metallurgy Research Center.
**EVALUATION OF STEEL MADE WITH FERROUS FRACTIONS FROM URBAN REFUSE Report of Investigations**
H. V. Makar, R. S. Kaplan, and L. Janowski Jun. 1975 32 p ref
(PB-243682/2; BM-RI-8037) Avail: NTIS HC $4.00 CSCL 11F

A two-part study was conducted to determine problems associated with the use of ferrous fractions from urban refuse as melting stock for steelmaking and to evaluate the resulting steel products. The first part of the study involved 50lb ingots from laboratory melts, and the second part included 50- and 800-lb ingots from 1-ton-electric-arc-furnace melts. In general, properties of the steel produced were not measurably affected by charge composition (that is, melting stock), melting practice, or method of scrap preparation. GRA

**N76-14258#** Sperry Univac, St. Paul, Minn. Defense System Div.
**TITANIUM-ALUMINUM ULTRA-THIN FILM DEPOSITION STUDY Final Technical Report, Oct. 1974 - Jun. 1975**
R. H. Dean, S. J. Lins, M. C. Paul, and E. J. Torok 24 Jun. 1975 73 p
(Contract DAAK02-75-C-0036)
(AD-A013584; PX-11332) Avail: NTIS CSCL 13/8

A process was developed for the vacuum deposition of multilayer titanium-aluminum films at a rate of one pound per hour. Source tooling was developed. Multi-titanium-aluminum films were vacuum deposited and removed from the substrate. Means of smoothing the substrate and releasing the multilayer thin films from the substrate were investigated. GRA

# 27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

**N76-14259** South Carolina Univ., Columbia.
**INSTRUMENTATION DEVELOPMENT AND CRYSTAL STRUCTURES INVOLVING METAL-CARBON AND METAL-SULFUR BONDS Ph.D. Thesis**
Alfred Graham Gash 1975 152 p
Avail: Univ. Microfilms Order No. 75-28969

Three inorganic complexes were synthesized, and their crystal structure analyses were carried out using single-crystal X-ray diffraction techniques. The compounds studied are: (1) pi-C6H6Pb(AlCl4)2 with C6H6; (2) bis(dithiobiureto)nickel(II); (3) decakis (thiourea) tetracopper(I) hexafluorosilicate monohydrate. The modification of a Picker card-controlled diffractometer for computer-controlled operation with the associated interface and software are also reported. Dissert. Abstr.

**N76-14260** Massachusetts Univ., Amherst.
**OXIDATION OF POLYMERS: MEASUREMENTS OF ABSOLUTE RATE CONSTANTS IN THE SOLID PHASE Ph.D. Thesis**
Shiou-Tarng Wang 1975 192 p
Avail: Univ. Microfilms Order No. 75-27559

Oxidations of polyolefins in solid phase were investigated at low conversions by an added initiator. The polymers were: tactic polypropylene, isotactic polypropylene (60 percent crystallinity), isotactic poly(1-butene) (50 percent crystallinity), and isotactic poly(4-methyl-pentene-1) (30 percent crystallinity). The results of the decomposition measurements of benzoyl peroxide (BP) in polyolefins showed this initiator to be soluble in the amorphous phase of the polymers, and to decompose by a first-order process to generate radicals with moderate efficiency. The decomposition of a, a'-azobisisobutyronitrile (AIBN) in polyolefin is complicated both by primary cage-recombination and by autocatalysis. This behavior suggests that AIBN is probably insoluble in the polymers and is not suitable as an initiator for polymer oxidation. Lauroyl peroxide (LP) was only cursorily evaluated. Its performance appears to be intermediate between BP and AIBN. Dissert. Abstr.

**N76-14261** Case Western Reserve Univ., Cleveland, Ohio.
**THE PREPARATION AND CHARACTERIZATION OF ULTRATHIN POLYMERIC FILMS AND MEMBRANES Ph.D. Thesis**
Albert Cemel 1975 179 p
Avail: Univ. Microfilms Order No. 75-27895

An investigation was conducted to study the preparation and characterization of ultrathin films prepared by the Langmuir-Blodgett dipping technique, and to determine the feasibility of using composite membranes of Langmuir-Blodgett multilayers on porous backing materials for reverse osmosis desalination membranes and learn the effects of membranes preparation technique, porosity, thickness, and chemical composition on the product water flux and salt rejection. Insoluble monomolecular films were formed on water surfaces and compressed to form close packed oriented layers. Using the Langmuir-Blodgett technique these layers were stacked one on top of another onto a solid substrate to form a well oriented array of molecules termed a multilayer. There is sufficient cohesive energy between the molecules in each monolayer that they will bridge the small pores in the substrate material. The multilayer membranes can be built from either monomeric monolayers which are subsequently polymerized by Co60 gamma radiation or directly from polymeric monolayers. Dissert. Abstr.

**N76-14262** Michigan Univ., Ann Arbor.
**STATISTICAL ELASTOMERIC PROPERTIES OF SOME SILICON-CONTAINING POLYMERS Ph.D. Thesis**
John Hsien-shyh Ko 1975 155 p
Avail: Univ. Microfilms Order No. 75-29262

The properties were investigated of several polymers in the important class of macromolecules having chain backbones made up of either Si-C or Si-O bonds. Dissert. Abstr.

**N76-14263** Case Western Reserve Univ., Cleveland, Ohio.
**STRUCTURE AND PROPERTIES OF ORDERED BLOCK COPOLYMER MEMBRANES Ph.D. Thesis**
Mark Irl Ostler 1975 173 p
Avail: Univ. Microfilms Order No. 75-27946

The temperature behavior of a series of styrene-butadiene-styrene triblock copolymer membranes was studied with high vacuum gas transmission, volume dilatometric, and mechanical damping measurements. The results of each of the techniques indicate that a change in polymer structure or mobility is occurring at room temperature or slightly above. The magnitude of the changes is highly dependent on the sample preparation conditions and, to a much lesser extent, on the copolymer composition. The characteristics of the property changes are important from the point of view that they occur within the normal end use temperature range of products manufactured from this type of copolymer. Dissert. Abstr.

**N76-14264*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**STRAIN ARRESTOR PLATE FOR FUSED SILICA TILE Patent**
Murat H. Kural, inventor (to NASA) (LMSC, Sunnyvale, Calif.) Issued 18 Nov. 1975 15 p Filed 28 Nov. 1973 Supersedes N74-15213 (12 - 06, p 0682) Sponsored by NASA
(NASA-Case-MSC-14182-1; US-Patent-3,920,339; US-Patent-Appl-SN-419748; US-Patent-Class-428-109; US-Patent-Class-403-28; US-Patent-Class-403-179; US-Patent-Class-428-214; US-Patent-Class-428-212; US-Patent-Class-428-447; US-Patent-Class-428-77; US-Patent-Class-428-416) Avail: US Patent Office CSCL 11A

An improvement is reported in the technique of attaching rigid thermal insulator tiles to metallic sub-panels or structural members on the exposed surfaces of spacecraft or other frameworks. Heretofore this was done by a flexible bond, but it was found that at temperatures below the glass transition range such bonds lose their flexibility and transfer more strains to the insulator tiles. Since the tiles are relatively weak and frangible, the effect of transmitted strains, whether mechanical or thermal, is cracking and spalling of the insulation material. The problem is solved by incorporation with the flexible bond, a strain arrestor plate, adjacent the insulator tile and secured to an adhesive which may be either a flexible bond or a hard bond. In addition to high strength and high stiffness, the strain arrestor plate must have a coefficient of thermal expansion preferably matching that of the rigid insulator tiles.
Official Gazette of the U.S. Patent Office

**N76-14265*#** ILC Industries, Inc., Dover, Del.
**DEVELOPMENT OF RESTRAINT MATERIAL AND TUCKED FABRIC JOINTS Final Report**
John M. McMullen 5 Sep. 1975 47 p
(Contract NAS9-14244)
(NASA-CR-144633; ILC-ER-857-07) Avail: NTIS HC $4.00 CSCL 11E

A study was conducted to evaluate and select a suitable restraint material for the exterior of space suits pressurized to 4.0 PSID for normal operations, and to develop and improve tucked fabric joints for motions associated with the human shoulder, elbow, knee, waist, hip, ankle, and wrist. The many attributes of the end items are summarized to include structural integrity, simplicity, low maintenance, lightweight, high durability, low elongation, full range mobility, long life, and resistance to degradation in the operational environment. Author

**N76-14266*#** Virginia Polytechnic Inst. and State Univ., Blacksburg. Chemistry Dept.
**EFFECT OF POLYMER PROPERTIES AND ADHEREND SURFACES ON ADHESION Final Report, Dec. 1974 - Nov. 1975**
David W. Dwight, Mary Ellen Counts, and James P. Wightman [1975] 99 p refs
(Grant NsG-1124)
(NASA-CR-145962) Avail: NTIS HC $5.00 CSCL 11A

The surface properties associated with good adhesive joints were evaluated in terms of application of adhesive bonding in aerospace technology. The physical and chemical nature was determined of Ti and Al adherend surfaces after various surface treatments, and the effects on fracture surfaces of high temperature aging, and variations in amide, anhydride, and solvent during polymer synthesis. The effects were characterized of (1) high temperature during shear strength testing, (2) fiber-reinforced composites as adherends, (3) acid/base nature of adherends, (4) aluminum powder adhesive filler, and (5) bonding pressure. Author

**N76-14267*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Space Sciences Lab.
**ELECTRETS AND THEIR APPLICATION IN CONTAMINATION STUDIES**
P Pillai, K. C. and Edward L. Shriver Washington Dec. 1975 98 p refs
(NASA-TR-R-457; M159) Avail: NTIS HC $5.00 CSCL 11B

Data are presented on the surface charge of many different types of electrets formed by several different techniques. Results are presented on the investigation of electrets as pollution control devices for their possible use in the control of a spacecraft environment. Author

**N76-14268*#** McDonnell-Douglas Corp., Long Beach, Calif.
**SEMICONDUCTING POLYMERS FOR GAS DETECTION Final Report, 1 Jul. 1974 - 29 Jun. 1975**
N. R. Byrd and M. B. Sheratte Dec. 1975 175 p refs
(Contract NAS3-18919)
(NASA-CR-134885) Avail: NTIS HC $6.75 CSCL 11G

Four conjugated polyenes, and two polyesters containing phthalocyanine in their backbone, were synthesized. These polymers were characterized by chemical analysis, thermogravimetric analysis, spectral analysis, and X-ray diffraction studies for crystallinity, as well as for their film-forming capability and gas/polymer interactions. Most of the polymers were relatively insensitive to water vapor up to 50 percent relative humidity, but the polyester/phthalocyanine (iron) polymer was relatively insensitive up to 100 percent RH. On the other hand, poly(p-dimethylaminophenylacetylene) was too conductive at 100 percent RH. Of the gases tested, the only ones that gave any evidence of interacting with the polymers were SO2, NOx, HCN and NH3. Poly(imidazole)/thiophene responded to each of these gases at all relative humidities, while the other polymers gave varying response, depending upon the RH. Thus, since most of these gases were electron-accepting, the electron-donating character of poly(imidazole)/thiophene substantiates the concept of electronegativity being the operating principle for interaction effects. Of the six polymers prepared, poly(imidazole)/thiophene first showed a very good response to smoldering cotton, but it later became non-responsive; presumably due to oxidation effects. However, poly(imidazole)/ferocene generally gave consistent responses. The other four did not. The reason for this is not known. Author

**N76-14269*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**MECHANICAL PROPERTIES AND ABRASION RESISTANCE OF POLYESTER CORD**
Jerry G. Williams Jan. 1976 31 p refs
(NASA-TM-X-72806) Avail: NTIS HC $4.00 CSCL 11G

Polyester cord material has been proposed for several space structures applications. The results of an investigation to measure the effects of simulated space environment factors (thermal, vacuum, and thermal-vacuum) on the mechanical properties of polyester cord are reported. Proposed space applications use polyester cord as a tension structure for pressurized enclosures. The end attachment in the region of access ports is a critical design feature and cord abrasion under cyclic loading is particularly important. Single cord and multiple cord end fixture cyclic load test results are reported for coated and noncoated material. The effects of preload on polyester cord ultimate strength are also reported. Author

**N76-14270*#** General Electric Co., Schenectady, N.Y.
**IMPROVED TOUGHNESS OF SILICON CARBIDE Final Report**
John A. Palm Nov. 1975 36 p refs
(Contract NAS3-17767)
(NASA-CR-134921; SRD-75-123) Avail: NTIS HC $4.00 CSCL 11B

Several techniques were employed to apply or otherwise form porous layers of various materials on the surface of hot-pressed silicon carbide ceramic. From mechanical properties measurements and studies, it was concluded that although porous layers could be applied to the silicon carbide ceramic, sufficient damage was done to the silicon carbide surface by the processing required so as to drastically reduce its mechanical strength. It was further concluded that there was little promise of success in forming an effective energy absorbing layer on the surface of already densified silicon carbide ceramic that would have the mechanical strength of the untreated or unsurfaced material. Using a process for the pressureless sintering of silicon carbide powders it was discovered that porous layers of silicon carbide could be formed on a dense, strong silicon carbide substrate in a single consolidation process. Author

**N76-14271*#** Washington Univ., Seattle.
**FUNDAMENTAL STUDIES ON THE NATURE AND PROPERTIES OF CERAMIC FIBER INSULATION**
J. I. Mueller, O. J. Whittemore, Jr., W. D. Scott, A. D. Miller, L. W. Smiser, and D. B. Leiser [1975] 98 p refs
(Contract NAS2-6541)
(NASA-CR-137793) Avail: NTIS HC $5.00 CSCL 11B

Silica and mullite fibers used to fabricate reusable surface insulation (RSI) for the space shuttle orbiter may devitrify/recrystallize within the temperature range anticipated upon reentry. This is shown to be dependent upon impurity level, temperature, and time at temperature. It is determined that the effects of the material improvement and optimization program are positive. The degree of crystallinity is shown to have a predominant effect upon the strength of fabricated RSI tile, and limits are determined. Models are developed to predict tensile strengths and shrinkage rates of silica tile based upon readily measurable parameters. Thermal cycling which simulates reentry results in an increase in the crystallinity and in the porosity of tile coatings. Author

**N76-14272#** General Dynamics Corp., Quincy, Mass. Shipbuilding Div.
**PREFAILURE EVALUATION TECHNIQUES FOR MARINE COATINGS**
George Rudlowski Feb. 1975 257 p refs
(Contract MA2-36215)
(COM-75-10927/2; MA-RD-930-75072) Avail: NTIS HC $9.00 CSCL 11C

Application tests made to obtain limited assurance that the coating system will perform satisfactorily are discussed. The minimum practical tests and controls which should be implemented to insure a successful coating system are given. GRA

**N76-14273#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**EFFECTS OF THE PHYSIOLOGICAL ENVIRONMENT ON THE LONG-TERM PHYSICAL PERFORMANCE OF POLYMERIC MATERIALS Annual Report, Dec. 1973 - Nov. 1974**
J. Moacanin, R. F. Fedors, J. D. Ingham, E. F. Cuddihy, and S. Chan 28 Apr. 1975 105 p refs Sponsored by NIH
(PB-243753/1; JPL-1200-242) Avail: NTIS HC $5.50 CSCL 06L

Dynamic fatigue in air and in saline solution was studied of a segmented polyether methane elastomer used as a flexible substrate for implantable devices. Causes for potential problem areas such as creep or solvent stress cracking were identified and related to morphology factors. The effects of adventitious products on properties was also assessed. A rotating disc device was constructed and its fluid flow characteristics enlarged. This device is used to study the erosion of blood-compatible coatings under flow conditions. Structure of water in hydrogel was studied using nuclear magnetic resonance. GRA

**N76-14274#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
**HANDBOOK OF THE INFRARED OPTICAL PROPERTIES OF Al2O3, CARBON, MgO, AND ZrO2, VOLUME 1 Interim Report**
Milo E. Whitson, Jr. 4 Jun. 1975 471 p refs
(Contract F04701-74-C-0075)
(AD-A013722; TR-0075(5548)-2-Vol-1; SAMSO-TR-75-131-Vol-1) Avail: NTIS CSCL 11/2

Volume 1 of this handbook presents the compiled results of a comprehensive survey of the open literature relevant to the infrared optical properties of aluminum oxide, carbon, magnesium oxide, and zirconium dioxide. Literature data were critically reviewed and representative data chosen or mathematically constructed for refractive and extinction indices, spectral and total emissivities, reflectance, and transmittance over the 1 to 1000 micrometer spectral range. All data are presented in both graphic and tabular format, and a cross-referenced bibliography is included. GRA

**N76-14275#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
**HANDBOOK OF THE INFRARED OPTICAL PROPERTIES OF Al2O3, CARBON, MgO, AND ZrO2, VOLUME 2 Interim Report**
Milo E. Whitson, Jr. 4 Jun. 1975 480 p
(Contract F04701-74-C-0075)
(AD-A013723; TR-0075(5548)-2-Vol-2; SAMSO-TR-75-131-Vol-2) Avail: NTIS CSCL 11/2

Volume II of the handbook presents the compiled results of a comprehensive survey of the open literature relevant to the infrared optical properties of carbon soots, graphite, glassy carbon, carbon films, pyrolitic graphite, MgO and oxide stabilized ZrO2. Literature data are presented for refractive and extinction indices, spectral and total emissivities, reflectance, and transmittance over the 1 to 1000 micrometer spectral range. GRA

**N76-14276#** Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
**HETEROGENEITIES IN CARBON FIBERS**
S. B. Warner, D. R. Uhlmann, and L. H. Peebles, Jr. 16 Aug. 1975 16 p refs
(Contract N00014-75-C-0542; NR Proj. 053-534)
(AD-A013666; TR-7) Avail: NTIS CSCL 11/5

Acrylic fibers, stabilized acrylic fibers and graphite fibers have been selectively etched by ion bombardment. After ion etching, the fibers are characterized by structures oriented transverse to the fiber axis with an average spacing ranging from 500-3000 A. These transverse structures are considered to be representative of structural inhomogeneities in the fibers, which are transmitted from the precursor fiber through the stabilization treatment to the final carbon fibers. The relation between these heterogeneities and the standard microstructural models of carbon fibers remains to be elucidated satisfactorily. Author (GRA)

**N76-14277#** Army Foreign Science and Technology Center, Charlottesville, Va.
**STUDY OF WETTING OF SAMPLES OF THE BN-B4C SYSTEM BY LIQUID METALS**
A. D. Panasyuk and T. V. Dobovik 29 Apr. 1975 9 p refs Transl. into ENGLISH from Dielektriki (USSR), no. 2, 1972 p 121-125
(AD-A014051; FSTC-HT-23-0629-75) Avail: NTIS CSCL 11/2

Production and testing of the wetting of BN, B4C and materials based on them by liquid metals are discussed. Results are presented as graphs and discussed. The results indicate the possibility of use of BN-B4C system materials as refractories with reactive metal melts. GRA

**N76-14278#** Army Foreign Science and Technology Center, Charlottesville, Va.
**THE WORK OF THE STATE INSTITUTE OF GLASS IN THE AREA OF GLASS HARDENING**
O. K. Botvinkin 29 Apr. 1975 6 p Transl. into ENGLISH from Tr. Vses. Nauchno-Issled. Inst. Stekla. (USSR), no. 1, 1971 p 107-109
(AD-A014053; FSTC-HT-23-0628-75) Avail: NTIS CSCL 11/2

An ion exchange method of hardening glass, by treating it in molten lithium salts, replacing the sodium ions by lithium, is

described. Also mentioned are developed work on chemical hardening of glass in liquids, with subsequent application of organosilicon protective coatings, use of ultrasound in chemical hardening of glass, chemical hardening and subsequent production of double sheet glass, with recycling of the etching agent, search for polymer coatings and methods of application of them to sheet and packaging glass and special purpose glass. A method now in production of horizontal tempering of automobile glass is mentioned. GRA

**N76-14279#** Army Foreign Science and Technology Center, Charlottesville, Va.
**A STUDY OF THE FINE STRUCTURE, THERMOMECHANICAL AND CHEMICAL PROPERTIES OF PHOTO-PYROCERAMICS CONTAINING BERYLLIUM**
A. I. Berezhnoi and A. S. Krasnikov Apr. 1975 9 p refs Transl. into ENGLISH from Vses. Khimicheskoe Obshchestvo. Zh. (USSR), no. 4, 1971 p 476-477
(AD-A014055; FSTC-HT-23-0757-75) Avail: NTIS CSCL 11/2

This article discusses research on adding beryllium to light-sensitive glass and photo-pyroceramics. Crystalline structure was studied by X-ray diffraction analysis. Microhardness and microdeformation were studied in relation to varying quantities of beryllium. Results showed that there is a connection between beryllium content and fine structure and thermomechanical properties of photo-pyroceramics. The addition of BeO stabilizes thermal expansion by preventing structure transformation of various forms of silica. GRA

**N76-14280#** Army Foreign Science and Technology Center, Charlottesville, Va.
**ULTRASOUND CHARACTERISTICS OF SOME INDUSTRIAL GLASSES**
G. N. Burovsteva, N. M. Pavlushkin, and R. Ya. Khodakovskaya 29 Apr. 1975 9 p refs Transl. into ENGLISH from Tr. Mosk. Khim.-Tekhnol. Inst. (USSR), no. 68, 1971 p 3-6
(AD-A014050; FSTC-HT-23-0627-75) Avail: NTIS CSCL 11/2

Experimental data of the authors and data in the literature, on the physical-chemical properties and ultrasound characteristics of numerous glasses were presented and discussed. Recommendations were made for use of certain glass systems with minimum sound velocities and minimum temperature coefficients of velocity for ultrasound line delays. GRA

**N76-14281#** Aerospace Research Labs., Wright-Patterson AFB, Ohio. Metallurgy and Ceramics Research Lab.
**HIGH TEMPERATURE DEFORMATION BEHAVIOR OF CERAMICS Final Report, Aug. 1967 - Jul. 1975**
Patrick K. Talty Jun. 1975 11 p refs
(AD-A013682; ARL-75-0156) Avail: NTIS CSCL 11/2

Studies have been conducted to define the creep behavior of high temperature ceramic materials of interest to the Air Force. The results of a study of yttria stabilized zirconia, a material used in regenerative storage heaters for blow down wind tunnels, are summarized. References to publications that present the details of this study are given. GRA

# 28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

**N76-14282#** Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
**INVESTIGATION OF RHEOLOGICAL PROPERTIES OF DILUTE SOLUTIONS OF POLYMERIC ANTIMIST AGENTS IN HYDROCARBON FUELS**
R. J. Mannheimer and W. D. Weatherford, Jr. Jun. 1975 23 p refs
(Contract DAAK02-73-C-0221)
(AD-A013502; AFLRL-59) Avail: NTIS CSCL 21/4

A dilute solution of polymeric antimist additive is found to offer unusually high resistance to flow through metal filters. This apparent anomaly is not due to filter plugging or polymer adsorption but may be explained in terms of an elongational viscosity that cannot be observed in ordinary viscometric flow. Measurements in different size filters indicate a slightly higher resistance with finer pore sizes; however, end effects were not significant. Preliminary results indicate that this anomalous resistance may be related to antimisting effectiveness.
Author (GRA)

**N76-14283#** Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Fuels Branch.
**STUDY OF ESTIMATION METHODS FOR HYDROGEN CONTENT AND HEAT OF COMBUSTION OF AVIATION TURBINE FUELS Final Technical Report, Dec. 1973 - Mar. 1974**
Leonard C. Angello May 1975 42 p refs
(AF Proj. 3048)
(AD-A013932; AFAPL-TR-74-76) Avail: NTIS CSCL 21/4

The value of using the hydrogen content of jet fuel as a measure of the fuel's combustion performance and an evaluation of the use of correlation equations to accurately calculate a fuel's hydrogen content based on other measured fuel properties (aniline point and gravity) have been documented. Subsequently, new correlation equations for calculating the hydrogen content and the heat of combustion of jet fuels have become available. It is the purpose of this report to evaluate these new equations and to determine their suitability for use in jet fuel specifications. A study was performed to determine the suitability of several newly developed equations for calculation of hydrogen content and net heat of combustion of JP-4 and Jet A fuels. Results of the evaluation indicate that two of the five hydrogen content equations and three of the four net heat of combustion equations are unconditionally acceptable for both JP-4 and Jet A fuels.
GRA

# 31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

**N76-14284*** National Aeronautics and Space Administration. Pasadena Office, Calif.
**HELIUM REFRIGERATOR Patent**
Ervin R. Wiebe, inventor (to NASA) (JPL) Issued 28 Oct. 1975 5 p Filed 12 Jun. 1974 Supersedes N74-28134 (12 - 17, p 2071) Sponsored by NASA
(NASA-Case-NPO-13435-1; US-Patent-3,914,950; US-Patent-Appl-SN-478803; US-Patent-Class-62-49; US-Patent-Class-62-129; US-Patent-Class-73-295) Avail: US Patent Office CSCL 20L

An improved helium refrigerator, which includes a means for providing a continuous signal indicative of the reserve cooling capacity of the refrigerator, is disclosed.
Official Gazette of the U.S. Patent Office

**N76-14285** British Library Lending Div., Boston Spa (England).
**DIRECTIVES FOR ELECTROSTATIC SPRAYING WITH PLASTIC POWDERS**
Nov. 1974 36 p Transl. into ENGLISH from VDMA Einheitsblaetter (West Germany), Mar. 1974 9 p
(BLL-SMRE-Trans-6419-(8313.4)) Avail: British Library Lending Div., Boston Spa, Engl.: 4 BLL photocopy coupons

A safety measures directive for the erection and operation of installations and appliances for electrostatic spraying with plastic powder is introduced. The directive gives measures that ensure, in case of dust explosions, persons will not be injured and that machine damage will be minimal. Data cover possible dangers to health, probability of reducing fire and explosions, and the prevention of explosions. E.H.W.

**N76-14286*#** Mathematica, Inc., Princeton, N.J.
**QUANTIFYING THE BENEFITS TO THE NATIONAL ECONOMY FROM SECONDARY APPLICATIONS OF NASA TECHNOLOGY**

30 Jun. 1975 182 p refs
(Contract NASw-2734)
(NASA-CR-145964) Avail: NTIS CSCL 05C

Economic benefits are discussed resulting from the application of four NASA technologies: cryogenic multilayer insulation, gas turbines in electric power generation, integrated circuits, and NASTRAN. For individual titles, see N76-14287 through N76-14293.

**N76-14287*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 1: OBJECTIVES AND APPROACH c83**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 2-21 refs (For availability see N76-14286 05-31)
CSCL 05C

The quantitative significance of NASA's contribution to nonaerospace knowledge is discussed in terms of economic benefits. Economic benefits are defined, and methods for measuring the economic benefits of technological advances are described. F.O.S.

**N76-14288*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 2: CRYOGENIC MULTILAYER INSULATION**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 23-50 refs (For availability see N76-14286 05-31)
CSCL 20L

The development of cryogenic technology is described with emphasis on multilayer insulation. The benefits of using multilayer superinsulation for liquid hydrogen, helium, and nitrogen are discussed. F.O.S.

**N76-14289*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 3: GAS TURBINES IN THE PRODUCTION OF ELECTRIC POWER c37**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 52-84 refs (For availability see N76-14286 05-31)
CSCL 21E

The gas turbine technology in electric power production is described, and the economic benefits of the technology applications are analyzed. F.O.S.

**N76-14290*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 4: INTEGRATED CIRCUITS c33**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 86-109 refs (For availability see N76-14286 05-31)
CSCL 09C

Integrated circuit technology is described, and the economic benefits of the technology application are analyzed. Results of using a demand curve to quantify the benefits are reported. F.O.S.

**N76-14291*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 5: NASTRAN c39**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 111-126 ref (For availability see N76-14286 05-31)
CSCL 20K

The NASTRAN computer program and the benefits of its use are discussed. The results of a survey of cost saving estimates by its users are given including start-up costs. F.O.S.

**N76-14292*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 6: CONCLUSIONS AND IMPLICATIONS c83**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 128-133 ref (For availability see N76-14286 05-31)
CSCL 09C

A summary and assessment are given of the study to develop procedures for quantifying the economic benefits of the applications of NASA technology. The methods of estimating benefits are evaluated. It is concluded that: (1) secondary benefits can be measured, (2) these benefits are in some cases impressively large, and (3) a complete assessment of the benefits of any R and D should recognize and attempt to account for benefits of secondary applications. F.O.S.

**N76-14293*** Mathematica, Inc., Princeton, N.J.
**APPENDIX A: INTERMEDIATE GOOD AND CONSUMERS' SURPLUS c83**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 135-176 (For availability see N76-14286 05-31)
CSCL 09C

The basic rationale is provided for interpreting cost savings measured in intermediate good (factor) markets as economic benefits. Specifically, the relationship between consumers' surplus in final good markets and the area under a factor, or intermediate good, demand curve above factor supply are discussed. This area is analogous to consumers' surplus and is designated here as SPF - the surplus to producers employing the factor. It is demonstrated how, under a variety of market structures, changes in SPF for a specific factor are related to changes in consumer surplus associated with final goods which use the factor in production. The extensions of the theory and their derivations are presented in order to make explicit the assumptions and limitations of the procedure employed for estimating economic benefits. Author

**N76-14294*#** Mathematica, Inc., Princeton, N.J.
**EXECUTIVE SUMMARY: QUANTIFYING THE BENEFITS TO THE NATIONAL ECONOMY FROM SECONDARY APPLICATIONS OF NASA TECHNOLOGY**
30 Jun. 1975 12 p
(Contract NASw-2734)
(NASA-CR-145963) Avail: NTIS HC $3.50 CSCL 05C

Preliminary estimates were prepared of the economic benefits to the U.S. economy from secondary applications of NASA technology. Technology is defined as the body of knowledge concerning how society's resources can be combined to yield economic goods and services, and NASA technology represents NASA's contribution to this body of technical knowledge. Secondary applications refer to uses of NASA generated knowledge for purposes other than those primary mission-oriented ones for which the original R&D was done. Case studies in cryogenics, integrated circuits, gas turbines, and NASTRAN are presented. Author

**N76-14295*#** Scientific Translation Service, Santa Barbara, Calif.
**INVESTIGATION OF THE OPERATING PROCESSES OF AN ABSORPTION LITHIUM-BROMIDE REFRIGERATION MACHINE WITH A SPRAY GENERATOR**
L. M. Rosenfeld and V. I. Dogolyatskiy Washington NASA Dec. 1975 13 p refs Transl. into ENGLISH from Izv. Sibirsk. Otd. AN SSSR, Ser. Tekhn. nauk (Novosibirsk), no. 3, issue 1, 1971 p 56-62
(Contract NASw-2791)
(NASA-TT-F-16805) Avail: NTIS HC $3.50 CSCL 13I

The results of an experimental investigation of a refrigeration machine with a spray generator are discussed. It was concluded after several tests that the spray generator increased the cooling efficiency by 10 to 15%. Phase diagrams are shown. Author

**N76-14296*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**THE DEEP SPACE NETWORK Progress Report, Jul. - Aug. 1975**
15 Oct. 1975 218 p refs
(Contract NAS7-100)
(NASA-CR-145923; JPL-PR-42-29) Avail: NTIS HC $7.75

Summaries are given of Deep Space Network progress in flight project support, tracking and data acquisition research and technology, network engineering, hardware and software implementation, and operations. For individual titles, see N76-14297 through N76-14310.

**N76-14297*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Office of Tracking and Data Acquisition.
**DSN FUNCTIONS AND FACILITIES AND DSN COMMAND SYSTEM MARK 3-75 c17**
N. A. Renzetti and W. G. Stinnett *In its* The Deep Space Network (date) p 1-9 (For availability see N76-14296 05-31)
CSCL 17B

The objectives, functions, and organization of the Deep Space Network are summarized. Deep space station, ground communication, and network operations control capabilities are described.

Special attention was given to the 1975 configuration of the Mark 3 command system, and its functional operation. Author

**N76-14298*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Systems Engineering Office.
**VIKING MISSION SUPPORT** **c14**
D. J. Mudgway, A. I. Bryan, and D. W. Johnston *In its* The Deep Space Network 15 Oct. 1975 p 10-14 refs (For availability see N76-14296 05-31)
CSCL 22D

All DSN preparations for the Viking A launch are presented. The final spacecraft compatibility tests were completed by July 7, and the personnel test and training effort was concluded on August 7. The first spacecraft was launched on August 20, 1975, and a brief summary of the coverage provided in the near-earth phase of the mission is included. Author

**N76-14299*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. DSN Systems Engineering Office.
**HELIOS MISSION SUPPORT** **c14**
P. S. Goodwin, W. G. Meeks, S. E. Reed, and R. E. Morris *In its* The Deep Space Network 15 Oct. 1975 p 15-19 ref (For availability see N76-14296 05-31)
CSCL 22D

The period between the first and second superior conjunction in Helios-1 mission operations is discussed. Helios-1 tracking coverage and system performance as well as results of initial Helios-B testing were covered. Author

**N76-14300*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Elements Research Section.
**S-BAND ZERO-DELAY DEVICE MULTIPATH TESTS ON THE 64-METER ANTENNA AT DSS 43, DSS 63, AND DSS 14** **c32**
T. Y. Otoshi *In its* The Deep Space Network 15 Oct. 1975 p 20-32 refs (For availability see N76-14296 05-31)
CSCL 17B

The results of a study to correlate the results of zero-delay subreflector tests with the multipath theory are presented. Good agreement between theory and experiment was obtained on both S-band range and signal level data at DSS 43, DSS 63, and DSS 14. It is shown that a movable subreflector technique can be used to isolate the principal multipath errors and enable a more accurate determination of the actual ground station delay. Author

**N76-14301*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**CALCULATING ACQUISITION BEHAVIOR FOR COMPLETELY DIGITAL PHASE-LOCKED LOOPS** **c33**
J. R. Lesh *In its* The Deep Space Network 15 Oct. 1975 p 33-45 refs (For availability see N76-14296 05-31)
CSCL 09C

The acquisition behavior of completely digital first and second order phase-locked loops is considered. It is shown that modeling the loop by its difference equations allows the acquisition behavior to be computed using a procedure wherein the number of computations as well as the required storage grow only linearly with the size of the state space. It is also shown that the procedure can be easily modified to include the effects of Doppler, finite length accumulators, and initial phase estimate jamming. Author

**N76-14302*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**THE EFFECT OF NOISE AND DIVERSITY ON SYNTHETIC ARRAY RADAR IMAGERY** **c32**
S. Butman and R. G. Lipes *In its* The Deep Space Network 15 Oct. 1975 p 46-53 refs (For availability see N76-14296 05-31)
CSCL 17I

Synthetic aperture radar (SAR) image quality was investigated as a function of received signal-to-noise ratio, multiple looks or diversity averaging of speckle, contrast, and resolution. Theoretical and simulation results are presented. The data are useful for tradeoff analyses in the design of the SAR, the image processing system, and the telemetry system. Photographs were made to show the effect of the above-mentioned parameters. The general conclusion is that diversity averaging produces an image far superior to that obtained via equivalent receiver signal-to-noise improvement. Author

**N76-14303*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Elements Research Section.
**AN X-BAND RADIOMETER FOR THE MICROWAVE WEATHER PROJECT** **c35**
M. S. Reid, O. B. Parham, and R. A. Gardner *In its* The Deep Space Network 15 Oct. 1975 p 54-59 refs (For availability see N76-14296 05-31)
CSCL 14B

A stabilized high resolution X-band radiometer was designed, constructed, and is presently operating at the Venus Deep Space Station in the Goldstone Deep Space Communications Complex in California. The radiometer is an automatically switched and automatically calibrated noise-adding radiometer and is used for atmospheric propagation research for the Microwave Weather Project. A description is given of the radiometer, its sensitivity, and examples of its performance. Author

**N76-14304*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
**AERODYNAMIC STATIC DIFFERENTIAL PRESSURE VALUES FOR THE 50 PERCENT POROUS REFLECTOR DISH** **c02**
M. S. Katow *In its* The Deep Space Network 15 Oct. 1975 p 60-65 refs (For availability see N76-14296 05-31)
CSCL 01A

Although the solid and the 25 percent porous thin paraboloidal dishes were instrumented with static pressure tubes and tested in the wind tunnel, the porosity used for the 64-m antenna was 50 percent for economic reasons. A method of extrapolating from available data the 50 percent porous pressure coefficient differences is described. The method is verified by checking the available wind tunnel static pressure data against the force data. Author

**N76-14305*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. RF Systems Development Section.
**RF AUTOMATION DEMONSTRATION, TRANSMITTER AUTOMATION, AND AUTOMATIC MICROWAVE CONFIGURATION CONTROL** **c32**
R. B. Crow, R. M. Gosline, and J. G. Leflang *In its* The Deep Space Network 15 Oct. 1975 p 66-79 refs (For availability see N76-14296 05-31)
CSCL 17B

The radio frequency (RF) automation demonstration was conceived to gather data for a life cycle study to evaluate the cost and operational effectiveness of automation. Demonstration ground rules and actual demonstrations performed at DSS 14 are given. Observations and data on the experiment are listed. Author

**N76-14306*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**DOPPLER SPECTRUM EXTRACTION OF PLANETARY RADAR DATA USING COMPUTER FFT AND INTEGRATION** **c60**
D. E. Wallis *In its* The Deep Space Network 15 Oct. 1975 p 86-94 (For availability see N76-14296 05-31)
CSCL 09B

A computer program to extract integrated Doppler spectra of planetary radar returns is described. The program input data are discrete, complex-valued time series obtained for each of 64 range gates. The data record is subdivided into successive subseries of 256 time-points, and each 256-point time series is discrete-Fourier-transformed using the fast Fourier transform (FFT). Power spectra are obtained by magnitude squaring. The power spectra, containing positive- and negative-frequency Doppler components, are assumed statistically stationary during receive runs of 10 to 15 minutes duration, and so may be (SNR)-enhanced by integration of successive 256-point power spectra. Program output is a highly compressed power spectrum tape containing 64 integrated spectra, together with identification and parameter values, for all receive runs made during each day of a total of six days of radar observations of the planet Mercury in calendar year 1974. Discussions of the on-site data-taking process and

the Doppler interpretation of the discrete Fourier transform are included. Author

**N76-14307*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**RADAR RANGING OF THE PLANET MARS AT 8495 MHz** **c32**
G. S. Downs and P. E. Reichley *In its* The Deep Space Network 15 Oct. 1975 p 95-106 refs (For availability see N76-14296 05-31)
CSCL 17I

A series of radar data sets to be used for Mars surface detection in 1975 was simulated and processed as a function of time delay and frequency. Appropriate signal-to-noise ratio was calculated for certain distances to the planet, assuming appropriate X-band antenna parameters. The round-trip time delay of the signal reflected from the surface of the planet was determined. Up to 120 delay measurements were made to allow determination of the detection probability and the measurement accuracy. Systematic errors in the measured delay with changes in surface roughness were observed. This effect is shown to be many times larger than the expected rms fluctuations in the measured delays. Author

**N76-14308*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**AUTOMATIC CONTROL OF DSS 13** **c89**
K. I. Moyd *In its* The Deep Space Network 15 Oct. 1975 p 107-114 refs (For availability see N76-14296 05-31)
CSCL 03A

The hardware, software, and control of the automatic pulsar data acquisition system at DSS 13 are described. Details of one observing run using the system are given. Modifications to be made in order to control the system remotely from JPL are described. Author

**N76-14309*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Network Operations Office.
**PSEUDO-DRVID: A NEW TECHNIQUE FOR NEAR-REAL-TIME VALIDATION OF RANGING SYSTEM DATA** **c32**
A. L. Berman *In its* The Deep Space Network 15 Oct. 1975 p 180-187 refs (For availability see N76-14296 05-31)
CSCL 17B

Reasons are presented as to why the Doppler and angle validation techniques cannot successfully be applied to ranging system data. A technique is described which can validate sequential range acquisitions in near-real-time to the 10-meter level. Author

**N76-14310*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Network Operations Office.
**OPERATIONS ANALYSIS OF INTERMEDIATE DATA RECORD PRODUCTION IN THE VIKING ERA** **c66**
D. C. Card *In its* The Deep Space Network 15 Oct. 1975 p 191-204 (For availability see N76-14296 05-31)
CSCL 12B

As a final step in the operations analysis of intermediate data record (IDR) production capability, dynamic system simulation models were constructed and executed within the context of the general purpose simulation system (GPSS) applications program on the Univac 1108 system. The dynamic models simulate all activity in the DSN ground systems which contributes to data flow characteristics and ultimate throughput times for the IDRs. Two basic model versions were constructed, representing alternative configurations at the merge processor: Model A simulates 4 tape-drive units at the merge processor; Model B simulates 8 tape-drive units. It was confirmed subsequently that the 8 tape-drive configuration will be implemented. Both basic models were driven, in dynamic simulation runs, by the same worst case mission support profile, representing the heaviest possible support requirement during the Viking encounter and planetary experiment period. Quantitative specification for system parameters, flow logic, and support profiles was derived. A 4 tape-drive configuration was found to meet a 24-hour throughput time requirement for IDRs. However, the simulated facilities are heavily loaded by the worst case profile; therefore, significant deviations from assumed facility availability or operational capabilities may have a critical effect upon performance to the requirement. Author

**N76-14311#** Stevens Inst. of Tech., Hoboken, N.J. Cryogenics Center.
**THERMOELECTRICITY AND REFRIGERATION AT LOW TEMPERATURES Final Report, Sep. 1974 - Jun. 1975**
John G. Daunt Jun. 1975 61 p refs
(Contract N00014-67-A-0202-0027)
(AD-A013606) Avail: NTIS CSCL 20/3

The research programs were: (A) Thermoelectricity at very low temperatures; (B) Physics of adsorbed gas layers and desorption refrigeration; (C) Experimental studies of cryogenic refrigeration. GRA

**N76-14312#** Naval Surface Weapons Center, White Oak, Md.
**INVESTIGATION OF TECHNIQUES TO REDUCE ELECTROSTATIC DISCHARGE SUSCEPTIBILITY OF HERMETICALLY SEALED EEDS**
Howard S. Leopold and Louis A. Rosenthal 3 Jul. 1975 50 p refs
(SF33354314)
(AD-A013595; NSWC/WOL-TR-75-57) Avail: NTIS CSCL 19/1

Ten different techniques were investigated to increase the safety of hermetically sealed Navy EEDs to human electrostatic discharge. The application of a conductive coating containing carbon particles was found to be the simplest and least expensive of the techniques explored. The coating can protect the EED from repeated discharges and can withstand four weeks of exposure to MIL-STD-331 Test 105.1 with no deterioration. GRA

**N76-14313#** Little (Arthur D.), Inc., Cambridge, Mass.
**INVESTIGATION OF SCROLL FLUID MACHINERY FOR CRYOGENIC HELIUM REFRIGERATORS Final Report, 1 Jun. 1973 - 31 Dec. 1973**
Raymond W. Moore, Jr. Feb. 1975 97 p refs
(Contract N00014-73-C-0451; NR Proj. 274-177)
(AD-A014070; ADL-C-75976) Avail: NTIS CSCL 13/1

The objective of the program was to investigate the applicability of scroll fluid machinery (compressors and expenders) to cryogenic helium refrigerators or liquefiers for superconductive ship propulsion systems. Thermodynamic cycles for appropriate refrigerator/liquefier systems have been analyzed; and, based on the results of this analysis, typical performance characteristics for a scroll compressor and a scroll expander suitable for these systems have been defined. Design requirements for the scroll compressor, a 90 SCFM unit with a 16 to 1 pressure ratio, have been established and a design for an experimental, oil-lubricated unit suitable for laboratory testing evolved. The design is based, in part, on information obtained from tests on the Arthur D. Little, Inc. (ADL) 1 to 3 Hp scroll compressor. The results of these tests are described. GRA

# 32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

**N76-14314** City Univ. of New York.
**THE PROPAGATION OF ELECTROMAGNETIC WAVES IN AN OVERDENSE PLASMA Ph.D. Thesis**
Robert John LaHaye 1975 124 p
Avail: Univ. Microfilms Order No. 75-28086

Linearly polarized electromagnetic waves with power densities up to 12 W/sq cm (f=2.45 GHz) are propagated along an external static magnetic field in a cylindrical waveguide. The power is pulsed with a duration of about 4 msec. Plasma is produced by electron cyclotron resonance. At the produced density the left component of the incident wave is nominally cut off. It was found that approximately 25% of the left wave power is transmitted through the plasma while a linear theory predicts

that less than 0.01% of the incident power should tunnel through. Dynamic measurements of the plasma density and electromagnetic field profiles during the transmission period were made and both show a transition from peaked on axis to annular configurations. Transmission of the left wave occurs for a time tau after the beginning of the microwave pulse until at t = tau it abruptly ceases, and the plasma becomes opaque to both the left and right handed incident electromagnetic waves. Dissert. Abstr.

**N76-14315** Northeastern Univ., Boston, Mass.
**AN INVESTIGATION OF NONLINEAR RECEIVERS FOR DIGITAL SIGNALING THROUGH CHANNELS WITH INTERSYMBOL INTERFERENCE Ph.D. Thesis**
Philip Lawrence Konop 1974 314 p
Avail: Univ. Microfilms Order No. 75-28888

The derivation and analysis is considered of receivers for digital communication over linear dispersive channels that introduce intersymbol interference and additive Gaussian noise. A maximum likelihood receiver structure is derived for bit-by-bit detection in binary channels when the intersymbol interference extends over a finite number of bits. It is found that the optimum maximum likelihood receiver structure is a generalized tapped delay line with feedback following a matched filter, with a complexity that increases as the span of the intersymbol interference rather than the length of the message. The performance of the maximum likelihood receiver is then tested through Monte-Carlo digital computer simulation using two types of optimum receiver structures along with the performance of various adaptive structures. It is found that the optimum receiver structure can be operated in an adaptive mode. Dissert. Abstr.

**N76-14316** Washington Univ., Seattle.
**MULTIPLE SCATTERING OF PULSED WAVES IN DISCRETE RANDOM MEDIA Ph.D. Thesis**
Shin Tsy Hong 1975 66 p
Avail: Univ. Microfilms Order No. 75-28363

The integral equation of two-frequency mutual coherence functions including the effects of multiple scattering and the motion of scatterers is derived for waves propagating through discrete random media. Subject to the validity of the parabolic approximation (forward scattering), the integral equation is approximated by a differential equation. The two-frequency small angle approximation of the radiative transfer equation is derived. These formulations and the solutions obtained are used for the analyses of coherence time, coherence bandwidth of waves, and the phenomena of pulsed waves in a time-varying discrete random medium. The effects of size distributions and random motions of scatterers are also presented. Dissert. Abstr.

**N76-14317** Ohio State Univ., Columbus.
**SCATTERING PROPERTIES OF PERIODIC ARRAYS CONSISTING OF RESONANT MULTI-MODE ELEMENTS Ph.D. Thesis**
Edward Lawrence Pelton 1975 179 p
Avail: Univ. Microfilms Order No. 75-26639

The scattering properties are investigated of periodic arrays of dipoles and of dipole geometries suitable as array elements. As a consequence of Babient's principle, the results obtained for the dipole arrays considered are directly applicable to thin complementary arrays of slots. Periodic arrays are useful as band-filters of electromagnetic radiation. Within a chosen reflection band, properly designed dipole arrays reflect incident signal in a manner comparable to a highly conducting solid metal surface. Outside the chosen reflection band incident signals pass through the array of dipoles. Complementary slotted metal screens function as bandpass filters, permitting incident signals having frequencies within a chosen operating band to pass through the array and attenuating signal transmission for frequencies outside the pass-band. As typical specific applications, a periodic array of dipoles is employed as a frequency selective sub-reflector in a dual frequency antenna system, and periodic arrays of slots have been used in the design of metallic radomes.
Dissert. Abstr.

**N76-14318** Minnesota Univ., Minneapolis.
**PERFORMANCE OF FM DISCRIMINATORS WITH FADING SIGNALS AND CO-CHANNEL INTERFERENCE Ph.D. Thesis**
Chotivid Chayavadhanangkur 1975 165 p
Avail: Univ. Microfilms Order No. 75-27139

The effect is investigated of co-channel interference on FM performance. The purpose is to find an analytical method to calculate baseband signal-to-noise ratio when the input to an FM receiver contains a desired and a cochannel interfering signal and additive Gaussian noise. Rice's click model is modified so as to include the interfering effect. The modified model is then used to obtain the baseband signal-to-noise ratio. Signal suppression due to the noise and interferer is studied. The results obtained are extended to the fading environment. Diversity systems, used to upgrade FM performance under fading environment, are studied. The diversity techniques considered are: Selection diversity, scanning diversity, maximal ratio combiner, and equal gain combiner. Dissert. Abstr.

**N76-14319** Michigan State Univ., East Lansing.
**THE THEORETICAL AND EXPERIMENTAL ANALYSIS OF ANTENNAS IN BOUNDED MEDIA WITH APPLICATION TO ELECTROMAGNETIC PROBING Ph.D. Thesis**
Carl Edward Grove 1975 385 p
Avail: Univ. Microfilms Order No. 75-27267

A theoretical and experimental investigation is made of coupled linear antennas in rectangular waveguide filled with a homogeneous, linear, isotropic medium. It is assumed that the antennas do not span the waveguide, the waveguide has arbitrary terminations and the medium is known in terms of its macroscopic electrical parameters. The integral equations for the unknown antenna currents are found by applying modal analysis and the Lorentz reciprocity relation to the electric field boundary condition on the antenna. First a delta function source model is assumed with both the thin wire and thin strip approximations made for the antenna. The integral equations are then solved numerically by the method of moments and the thin strip approximation is shown to exhibit improved convergence properties over the conventional thin wire approximation.
Dissert. Abstr.

**N76-14320** California Univ., Los Angeles.
**ELECTROMAGNETIC RADIATION AND SCATTERING FROM CONVEX BODIES COMPOSED OF ELECTRICALLY DISSIMILAR MATERIALS Ph.D. Thesis**
George Anthony Tadler 1975 334 p
Avail: Univ. Microfilms Order No. 75-26995

The electromagnetic radiation and scattering characteristics of the infinitely long elliptic cylinder and prolate spheroid are studied for the special case where the surface of these bodies possess dissimilar electrical properties. The surface impedance considered in this study could be physically realized by lossy materials, corrugations, statistically rough surfaces, surfaces coated by ablating or ferrite materials and active surfaces. For both bodies, the problem is solved by the classical separation of variables approach when the surface impedance assumes a special spatial variation, and by the method of moments technique in conjunction with the Leontovich impedance boundary condition when the surface impedance is arbitrary. Dissert. Abstr.

**N76-14321*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**MULTICHANNEL LOGARITHMIC RF LEVEL DETECTOR Patent**
Chase P. Hearn and Curtis L. Shriver, inventors (to NASA) Issued 28 Oct. 1975 6 p Filed 20 Mar. 1974 Supersedes N74-20019 (12 - 11, p 1290)
(NASA-Case-LAR-11021-1; US-Patent-3,916,316; US-Patent-Appl-SN-453115; US-Patent-Class-325-304; US-Patent-Class-325-306; US-Patent-Class-325-372; US-Patent-Class-328-145; US-Patent-Class-343-176) Avail: US Patent Office CSCL 17B

The invention is a logarithmic RF level detector which can be used to derive gain-weighting signals in an n-channel angle modulation diversity receiving system. The IF signals are sequentially gated into a single logarithmic IF amplifier which compresses the input signal dynamic range by a factor on the order of a hundred to one. The amplifier output signal is detected and then gated back into the n-channels simultaneously with the gating of the signals into the logarithmic amplifier. After being gated back into its channel each signal feeds a low pass

filter which passes only the low pass, or zeroth order zone. The signals so derived may then used to actuate a diversity combination operation. Official Gazette of the U.S. Patent Office

**N76-14322** Cornell Univ., Ithaca, N.Y.
**PROPERTIES OF TRANSITION RADIATION Ph.D. Thesis**
Neal James Maresca 1975 199 p
Avail: Univ. Microfilms Order No. 75-27046

Several fundamental electromagnetic problems associated with the transition radiation accompanying the passage of charged particles through perfectly conducting planar surfaces were investigated. For a charge of uniform but arbitrary velocity incident normally on a grounded, infinitely conducting plane, the exact transition field were obtained, allowing a detailed analysis of both the radiation distribution and associated transition events. The radiation in this case is also computed by both direct integration of the constructed surface current, and the 'pair annihilation' interpretation of the problem. Subsequent investigation of the electromagnetic annihilation of charge allows establishment of the 'annihilation radiation theorem' relating charge self-energy to annihilation energy. The problem of the radiation loss due to a charge passing through a hole in the plane is formulated and solved by 'interpolating' between the computed nonrelativistic and existing ultra-relativistic solutions. Dissert. Abstr.

**N76-14323#** Joint Publications Research Service, Arlington, Va.
**SCATTERING OF WAVES STATISTICALLY IRREGULAR SURFACES, PART 1**
I. M. Fuks 31 Oct. 1975 287 p Transl. into ENGLISH of the book "Rasseyaniya Voln na Statisticheski Nerovnoy Poverknosti" Moscow, 22 Sep. 1972 p 1-424
(JPRS-66061-1) Avail: NTIS HC $9.25

Methods are presented for solving problems in the diffraction of electromagnetic and acoustic waves by statistically irregular or inhomogeneous surfaces. For individual titles, see N76-14324 through N76-14330.

**N76-14324** Joint Publications Research Service, Arlington, Va.
**PRINCIPAL EQUATIONS OF THE PROPAGATION OF WAVES**
*In its* Scattering of Waves Statistically Irregular Surfaces, Pt. 1 (JPRS-66061-1) 31 Oct. 1975 p 9-33 Transl. into ENGLISH of the book "Rasseyaniya Voln na Statisticheski Nerovnoy Poverknosti" Moscow, 22 Sep. 1972 p 1-57 (For availability see N76-14323 05-32)

The equations for the propagation of sound in liquids and gases are derived along with equations for the propagation of electromagnetic waves. F.O.S.

**N76-14325** Joint Publications Research Service, Arlington, Va.
**STATISTICAL FORMULATION OF THE DIFFRACTION PROBLEM**
*In its* Scattering of Waves Statistically Irregular Surfaces, Pt. 1 (JPRS-66061-1) 31 Oct. 1975 p 34-69 Transl. into ENGLISH of the book "Rasseyaniya Voln na Statisticheski Nerovnoy Poverknosti" Moscow, 22 Sep. 1972 p 1-58 (For availability see N76-14323 05-32)

Formulas based on the statistical properties of irregular surfaces and random wave fields are derived for the solution of wave equations for the diffraction of waves by irregular surfaces. F.O.S.

**N76-14326** Joint Publications Research Service, Arlington, Va.
**PROPAGATION OF WAVES OVER SURFACE WITH SMALL, GENTLY UNDULATING IRREGULARITIES**
*In its* Scattering of Waves Statistically Irregular Surfaces, Pt. 1 (JPRS-66061-1) 31 Oct. 1975 p 70-95 Transl. into ENGLISH of the book "Rasseyaniya Voln na Statisticheski Nerovnoy Poverknosti" Moscow, 22 Sep. 1972 p 1-41 (For availability see N76-14323 05-32)

The effect on wave propagation by the incidence of a wave at an individual small irregularity is considered. The propagation of soundwaves over absolutely soft, statistically irregular surfaces is discussed along with the boundary conditions for mean and fluctuating electromagnetic fields. F.O.S.

**N76-14327** Joint Publications Research Service, Arlington, Va.
**FLUCTUATIONS OF WAVE FIELD OVER STATISTICALLY IRREGULAR SURFACES**
*In its* Scattering of Waves Statistically Irregular Surfaces, Pt. 1 (JPRS-66061-1) 31 Oct. 1975 p 96-136 Transl. into ENGLISH of the book "Rasseyaniya Voln na Statisticheski Nerovnoy Poverknosti" Moscow, 22 Sep. 1972 p 1-45 (For availability see N76-14323 05-32)

The characteristics of a scattered field are discussed. Topics discussed include: intensity of fluctuations of sound in the Fraunhofer zone, intensity of fluctuations in the near zone, and fluctuations of amplitude and phases. F.O.S.

**N76-14328** Joint Publications Research Service, Arlington, Va.
**SCATTERING BY MOVING SURFACES**
*In its* Scattering of Waves Statistically Irregular Surfaces, Pt. 1 (JPRS-66061-1) 31 Oct. 1975 p 137-166 Transl. into ENGLISH of the book "Rasseyaniya Voln na Statisticheski Nerovnoy Poverknosti" Moscow, 22 Sep. 1972 p 1-52 (For availability see N76-14323 05-32)

The energy spectrum was investigated of the time fluctuations for scattered monochromatic waves by moving surfaces. Random oscillations of an interface, the energy spectrum of a reflected field, and the spectrum of amplitude and phase fluctuations are discussed. F.O.S.

**N76-14329** Joint Publications Research Service, Arlington, Va.
**CORRELATION FUNCTIONS OF FIELD SCATTERED BY ROUGH SURFACES**
*In its* Scattering of Waves Statistically Irregular Surfaces, Pt. 1 (JPRS-66061-1) 31 Oct. 1975 p 167-198 Transl. into ENGLISH of the book "Rasseyaniya Voln na Statisticheski Nerovnoy Poverknosti" Moscow, 22 Sep. 1972 p 1-32 (For availability see N76-14323 05-32)

The fluctuation intensity and spectrum of a wave field scattered by statistically irregular surfaces are considered local characteristics of the random field. Correlation functions of the field in different limiting cases are obtained by the method of perturbations, i.e. grazing and nongrazing propagation, minute and large irregularities, infinite and confined scattering surfaces, and so on. Author

**N76-14330** Joint Publications Research Service, Arlington, Va.
**SCATTERING BY LARGE-SCALE IRREGULARITIES**
*In its* Scattering of Waves Statistically Irregular Surfaces, Pt. 1 (JPRS-66061-1) 31 Oct. 1975 p 199-284 Transl. into ENGLISH of the book "Rasseyaniya Voln na Statisticheski Nerovnoy Poverknosti" Moscow, 22 Sept. 1972 p 1-65 (For availability see N76-14323 05-32)

Wave scattering by a surface whose characteristic dimensions of the irregularities significantly exceed the wavelength of the diffracted field was studied. Topics discussed include: method of tangent plane, scattering index of scalar field, scattering of electromagnetic waves, and the effective height distribution functions and slope distribution in the presence of shadows. F.O.S.

**N76-14331#** Joint Publications Research Service, Arlington, Va.
**SCATTERING OF WAVES BY STATISTICALLY IRREGULAR SURFACES, PART 2**
F. G. Bass and I. M. Fuks 31 Oct. 1975 198 p refs Transl. into ENGLISH from the book "Rasseyaniye Voln na Statisticheski Nerovnoy Poverkhnosti" Moscow, Izd. Nauka, 22 Sep. 1972 p 1-424
(JPRS-66061-2) Avail: NTIS HC $7.50

Studies concerning fluctuations of scattered fields by large scale irregularities, scattering by bodies of finite size, two scale models, and methods of Green function in multiple scattering. For individual titles, see N76-14332 through N76-14335.

**N76-14332** Joint Publications Research Service, Arlington, Va.
**FLUCTUATIONS OF FIELD SCATTERED BY LARGE-SCALE IRREGULARITIES, CHAPTER 8**
*In its* Scattering of Waves by Statistically Irregular Surfaces, Part 2 (JPRS-66061-2) 31 Oct. 1975 p 285-345 Transl. into ENGLISH from the book "Rasseyaniye Voln na Statisticheski Nerovnoy Poverkhnosti" Moscow, Izd. Nauka, 22 Sep. 1972

(For availability see N76-14331 05-32)

Scattering by a surface whose dimensions of the rough area are very large, or infinite in one or two directions was examined within the framework of the Kirchhoff method. The mean field and intensity of fluctuations over an unbounded surface, and the fluctuations of intensity over a surface with undulating irregularities are discussed along with spatial correlation functions, and the frequency spectrum of a scattered field. F.O.S.

**N76-14333** Joint Publications Research Service, Arlington, Va.
**SCATTERING BY BODIES OF FINITE SIZE, CHAPTER 9**
*In its* Scattering of Waves by Statistically Irregular Surfaces, Part 2 (JPRS-66061-2) 31 Oct. 1975 p 346-380 Transl. into ENGLISH from the book "Rasseyaniye Voln na Statisticheski Nerovnoy Poverkhnosti" Moscow, Izd. Nauka, 22 Sep. 1972 (For availability see N76-14331 05-32)

Scattering was studied for the case when the mean surface is a curvilinear surface of finite dimensions. Reflection and refraction by a curvilinear surface, and the cross section of scattering by a smooth body are discussed along with the reflection by a rough body, and the fluctuations of scattering cross sections for amplitude and phase. F.O.S.

**N76-14334** Joint Publications Research Service, Arlington, Va.
**TWO-SCALE MODEL, CHAPTER 10**
*In its* Scattering of Waves by Statistically Irregular Surfaces, Part 2 (JPRS-66061-2) 31 Oct. 1975 p 391-400 Transl. into ENGLISH from the book "Rasseyaniye Voln na Statisticheski Nerovnoy Poverkhnosti" Moscow, Izd. Nauka, 22 Sep. 1972 (For availability see N76-14331 05-32)

Wave scattering by an agitated sea surface was studied. Experimental results on scattering by a statistically irregular surface are discussed along with the perturbation method for a curvilinear surface. F.O.S.

**N76-14335** Joint Publications Research Service, Arlington, Va.
**METHODS OF GREEN'S FUNCTION IN MULTIPLE SCATTERING THEORY, CHAPTER 11**
*In its* Scattering of Waves by Statistically Irregular Surfaces, Part 2 (JPRS-66061-2) 31 Oct. 1975 p 401-480 refs Transl. into ENGLISH from the book "Rasseyaniye Voln na Statisticheski Nerovnoy Poverkhnosti" Moscow, Izd. Nauka, 22 Sep. 1972 (For availability see N76-14331 05-32)

Diffraction phenomena were studied in regions bounded by two or more scattering surfaces such as in waveguides, resonators, and thin films. A theory that sums up the multiple rescattered fields is proposed which is a generalization of the Green functions formulated for the needs of the quantum theory. The attenuation of normal waves in hollow cosed waveguides is discussed. F.O.S.

**N76-14336#** Research Inst. of National Defence, Stockholm (Sweden).
**COMPUTED MIE SCATTERING PROPERTIES FOR LASER WAVELENGTHS IN VARIOUS ATMOSPHERIC MEDIA**
Ove Steinvall Mar. 1974 41 p refs
(FOA-2-C-2662-E1-E3) Avail: NTIS HC $4.00

Computer calculations of the Mie scattering properties of some haze, fog, cloud and smoke models were made for six laser wavelengths from 0.337 to 10.6 microns. For each wavelength the volume backscattering function and the total extinction and scattering coefficients are given. The angular volume scattering for some wavelengths is also presented. Author

**N76-14337*#** Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
**DESIGN OF A VIDEO SYSTEM PROVIDING OPTIMAL VISUAL INFORMATION FOR CONTROLLING PAYLOAD AND EXPERIMENT OPERATIONS WITH TELEVISION Final Report**
30 Jun. 1975 101 p
(Contract NAS9-14266)
(NASA-CR-144637) Avail: NTIS HC $5.50 CSCL 17B

A program was conducted which included the design of a set of simplified simulation tasks, design of apparatus and breadboard TV equipment for task performance, and the implementation of a number of simulation tests. Performance measurements were made under controlled conditions and the results analyzed to permit evaluation of the relative merits (effectivity) of various TV systems. Burden factors were subsequently generated for each TV system to permit tradeoff evaluation of system characteristics against performance. For the general remote operation mission, the 2-view system is recommended. This system is characterized and the corresponding equipment specifications were generated. Author

**N76-14338#** Research Inst. of National Defence, Stockholm (Sweden).
**ANTENNA ARRAY WITH CIRCULAR WAVEGUIDE ELEMENTS AND THEIR IMPEDANCES [GRUPPANTENNER MED CIRKULAERA VAGLEDARE OCHDERAS IMPEDANSANPASSNING]**
Hans Steyskal and Viggo Westerlin Feb. 1974 71 p refs In SWEDISH
(FOA-3-C-3768-E2) Avail: NTIS HC $4.50

The theoretical basis for calculating the active reflection coefficient of a plane infinite antenna array with circular dielectric filled wave guides in a symmetrical pattern has been presented by Amitay and others. Such computer programs are made use of in this report to analyze a number of different geometrical arrangements for antennas. Consideration is given to ten wave guide modes and 98 free space modes. Also presented is an optimization program for impedance matching of antenna elements by means of sections with alternate high and low dielectric constants. The possibilities of impedance matching as a function both of control angle and of frequency, are studied and many numerical results are given. In the optimization program only the fundamental component of the input reflection coefficient is taken into account. A third computer program is presented which analyzes the matching of this antenna element in more detail and for this purpose takes 10 modes into account, as a check that the approximations are permissible and that higher modes do not have too great an influence. Author

**N76-14339#** Research Inst. of National Defence, Stockholm (Sweden).
**CALCULATION OF ELECTROMAGNETIC BACKSCATTERING FROM A SPHERICAL DIELECTRIC SHELL**
Kjell Oestberg Feb. 1974 27 p refs
(FOA-3-C-3777-E1) Avail: NTIS HC $4.00

The radar cross section of a dielectric bubble is calculated numerically and studied as a function of radius, bubble thickness and refractive index. The refractive index is assumed to be real. The calculations are based on the exact solution, but the usefulness of high and low frequency approximations are also demonstrated. Author

**N76-14340#** Harry Diamond Labs., Adelphi, Md.
**ANALYSES IN MAGNETIC RECORDING OF VHF SIGNALS**
Karl H. Krey and Alfred G. Liberman (Natl. Bur. of Standards, Washington, D.C.) Jan. 1975 58 p refs
(DNA Proj. NWET-K11BAXE; HDL Proj. 232329)
(AD-A013525; HDL-TR-1695) Avail: NTIS CSCL 14/3

The technology of instrumentation recording is analyzed in respect to ultrawideband (VHF) recording requirements. Emphasis is given to problem areas that traditionally have prevented or retarded the advancements in ultrawideband tape recording. Concepts of VHF analog recording are discussed; problem areas are reviewed; and solutions are outlined. Extension of the upper frequency is realized by recording with higher tape velocities and at shorter wavelengths. Attention is therefore drawn to the driven-gap-spacer recording head, which is analyzed in relation to the recording of very short wavelengths. GRA

**N76-14341#** Research Inst. of National Defence, Stockholm (Sweden).
**TIME DIVERSITY: A REALIZATION AND SOME COMPARISONS [TIDSDIVERSITE - EN REALISERING OCH NAGRA JAEMFOERELSER]**
Nils-Erik Vall Apr. 1974 85 p refs In SWEDISH
(FOA-3-A-3771-E2) Avail: NTIS HC $5.00

A twofold time diversity system with diversity branches in time multiplex has been developed for data transmission by time variable channels. The system has been planned for either spatial or frequency diversity to give a fourfold diversity. Systems principles, assembly and functions are given together with results

from a trial series of tests on a communication link using stratosphere propagation as well as on a short wave link. Also in an introductory chapter, starting from a simple channel model, opinions are expressed on the operation of the diversity and on the choice of detection method and system adopted. Author

**N76-14342#** Research Inst. of National Defence, Stockholm (Sweden).

**PROPAGATION ATTENUATION IN THE FREQUENCY BAND 30 TO 1000 MHz. INVESTIGATION OF SOME COMMUNICATION LINKS IN ONE OF Cfs PLANNED ALARM SYSTEMS [UTBREDNINGSDAEMPNING I FREKVENSOMRADET 30 - 1000 MHz. UNDERSOEKNING AV NAGRA FOERBINDELSESTRAECKOR I ETT AV Cfs PLANERAT LARMSYSTEM]**

Lennart Nilsson Jun. 1974 20 p refs In SWEDISH
(FOA-3-C-3779-E2) Avail: NTIS HC $3.50

Suitable working frequencies were analyzed for planned radio controlled alarm system field strength measurements over a number of potential connecting links in the civil defense district of Gothenburg. Comparisons between measured and maximum permissible transmission loss showed that the working frequency for the established links can be placed arbitrarily within the tested frequency range. The same was valid in the mobile case, provided directional antennae were used on mobile stations. The polarization can similarly be chosen in an arbitrary manner. If omnidirectional antennae were used on mobile stations, the frequency range ought to be restricted to a maximum of about 600 MHz. The polarization was confined to the vertical in this instance. Author

**N76-14343#** Research Inst. of National Defence, Stockholm (Sweden).

**MEASUREMENT OF CURVES FOR THE PROBABILITY OF DETECTION OF SIMULATED TARGET SIGNALS IN A DOPPLER RADAR EQUIPPED WITH DIGITAL DETECTION SYSTEM [UPPMAETNING AV KURVOR OEVER UPPTAECKTSSANNOLIKHETEN FOER EN SIMULERAD MALSIGNAL I EN DOPPLERRADAR FOERSEDD MED DIGITAL SIGNALBEHANDLING]**

Olov Hoernaeus and Gunnar Silver May 1974 56 p refs In SWEDISH
(FOA-3-C-3780-E8) Avail: NTIS HC $4.50

A measurement of Doppler detection probabilities depending on A/D transformer quantization, showed that the receiver's thermal interference level should not consist of less than one or two quantization levels. A comparison between linear, exponential and binary integrators, showed that the linear system gave the greatest likelihood of detection, followed by the exponential and lastly the binary. In relation to the other two, the exponential threshold was within + or - 1 db. For measurements on the binary integrator at a false alarm rate of 10/4, it was found that the optimal minimum signal excess above the original threshold, was about 40% of the maximum possible in order to give a good probability of detection. The number of pulses dealt with by the integrator then agreed with the number of pulses for over scanning. Author

**N76-14344*#** California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.

**RELATIVISTIC NONLINEAR PLASMA WAVES IN A MAGNETIC FIELD**

C. F. Kennel and R. Pellat Oct. 1975 59 p refs Prepared in cooperation with Ecole Polytechnique, Paris
(Grant NGL-05-007-190)
(NASA-CR-145959; Pub-1499; PPG-243) Avail: NTIS HC $4.50 CSCL 20N

Five relativistic plane nonlinear waves were investigated: circularly polarized waves and electrostatic plasma oscillations propagating parallel to the magnetic field, relativistic Alfven waves, linearly polarized transverse waves propagating in zero magnetic field, and the relativistic analog of the extraordinary mode propagating at an arbitrary angle to the magnetic field. When the ions are driven relativistic, they behave like electrons, and the assumption of an 'electron-positron' plasma leads to equations which have the form of a one-dimensional potential well. The solutions indicate that a large-amplitude superluminous wave determines the average plasma properties. Author

**N76-14345*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.

**THE EFFECTS OF AN ION-THRUSTER EXHAUST PLUME ON S-BAND CARRIER TRANSMISSION**

William E. Ackerknecht, III and Philip H. Stanton 1 Jan. 1976 67 p refs
(Contract NAS7-100)
(NASA-CR-145919; JPL-TM-33-754) Avail: NTIS HC $4.50 CSCL 20N

The magnitude of the effects of an ion thruster plume on S-band signals is measured. Modeling techniques are developed to predict the effects. Results show that the RF signal transmitted through an ion thruster plume is reduced in amplitude and shifted in phase. An increase in noise is also experienced. Author

**N76-14346** British Broadcasting Corp., Kingswood (England). Research Dept.

**LF AND MF PROPAGATION: AN APPROXIMATE FORMULA FOR ESTIMATING SEA GAIN**

P. Knight Nov. 1975 9 p refs
(BBC-RD-1975/32) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The strength of waves propagated via the ionosphere at l.f. or m.f. may be increased if either path terminal is situated near the sea. This increase, which is known as sea gain, depends both on the distance of the terminal from the coast and on the extent of the sea beyond the coastline. An approximate formula was derived for estimating sea gain for all geographical situations which are likely to be encountered. Author

**N76-14347#** Communications Research Centre, Ottawa (Ontario). Technology and Systems Branch.

**ATTITUDES TOWARDS CHANGES IN COMMUNICATIONS TECHNOLOGY: THE INTRODUCTION OF TELECONFERENCING**

J. W. Gartrell (Thames Group Res. Inc.) and Nicole M. Mendenhall Oct. 1975 42 p
(CRC-1280) Avail: NTIS HC $4.00

A questionnaire survey was conducted in the regional offices of the Department of Communications in the summer of 1974 to determine the attitudes and perception of managers towards the installation and usage of an audio teleconferencing system. This data was compared with results obtained from a previous survey conducted at headquarters. The following results were obtained: (1) regional respondents indicated more positive attitudes towards the introduction of teleconferencing than headquarters respondents; (2) the perceived need and utility of teleconferencing facilities were higher in the regions than those reported by headquarters respondents; (3) respondents of both samples did not perceive the possible effects of this medium on communication behavior; (4) both samples indicated a need for audiographics or audio-visual facilities to conduct their meetings. Author

**N76-14348*#** RCA Service Co., Inc., Springfield, Va.

**TEST PLAN AND PRELIMINARY REPORT OF AIRBORNE ELECTROMAGENTIC ENVIRONMENT SURVEY OVER USA URBAN AREAS 0.4 TO 18.0 GHz**

Ralph E. Taylor and James S. Hill Dec. 1975 80 p
(Contract NAS5-24035)
(NASA-CR-2640) Avail: NTIS HC $5.00 CSCL 17B

An airborne electromagnetic environment survey is described of five urban areas where terrestrially-generated radio-frequency interference was measured over the frequency range from 0.4 to 18.0 GHz. A chartered Cessna 402 aircraft contained necessary measurement test equipment, including the receiving antennas mounted beneath the fuselage. Urban areas including Washington, D.C.; Baltimore, MD; Philadelphia, PA; New York, NY; Chicago, ILL; and Palestine, TX were surveyed. A flight test plan and preliminary test results for the 0.4 to 1.4 GHz frequency range, are included; a final test report describes more detailed results. Author

**N76-14349#** Fondazione Ugo Bordoni, Rome (Italy). Centro Onde Millimetriche.

**ON THE IMPORTANCE OF POWER SPECTRA OF CIRCULAR WAVEGUIDE MECHANICAL DEFORMATIONS**

Paolo Bernardi (Centro Studi e Lab. Telecomun., Turin), Gabriele

Falciasecca (Univ. di Bologna), and Guido Magni (Soc. Ital. Reti Telefoniche Interurbane) 8 Jan. 1975 14 p
Avail: NTIS HC $3.50

The importance of the deformation power spectra in the correlation between mechanical and electrical properties is shown for continuous deformations. The use of power spectra as specification masks for the manufacturing process is suggested. Two set-ups suitable for power spectra estimation are described, one for diameter variation and ellipticity due to the manufacturing process, and the other for straightness deviation due to the laying process. Author (ESA)

**N76-14350#** Army Electronics Command, Fort Monmouth, N.J.
**A DIGITAL SOUNDER SYSTEM FOR SINGLE SITE LOCATION AND TACTICAL COMMUNICATION NEEDS Final Report**
F. J. Gorman, Jr. Jul. 1975 17 p refs
(DA Proj. 1T1-61102-B-31A)
(AD-A013495; ECOM-4331) Avail: NTIS CSCL 17/2

This report documents a technique to determine the ionospheric structure in real time. The study of ionospheric structure consists of electron density profile calculations and frequency management prediction charts. Until this time, no automatic system could evaluate ionospheric data. Analog sounders produced data which was evaluated manually and then processed off-line by large digital computers. This technique was expensive in terms of computer costs and also inefficient due to the fact that sounder routines could not be changed rapidly enough to adjust to varying ionospheric conditions. Author (GRA)

**N76-14351#** Parke Mathematical Labs., Inc., Carlisle, Mass.
**A COMPUTER SIMULATION SCHEME FOR AN AIRCRAFT MOVING TARGET INDICATION SYSTEM, PART 1 Interim Report**
Theordore B. Barrett Jun. 1975 53 p refs
(Contract F19628-73-C-0125; AF Proj. 5635)
(AD-A013791; AFCRL-TR-75-0313-Pt-1; SR-1) Avail: NTIS CSCL 17/9

This is the first part of the general description of several computer subroutines which have been written for use in an AMTI radar simulation scheme. Chapter I describes the overall system which allows many simulator components to be conveniently interconnected. In addition, a scheme for displaying results is described. Chapter II is a detailed description of the clutter and moving target signal simulator. This device is the front end of the overall simulation scheme. GRA

**N76-14352#** Naval Postgraduate School, Monterey, Calif.
**MOVING TARGET INDICATION BY NONCOHERENT DETECTION M.S. Thesis**
Isaac Levin Jun. 1975 46 p refs
(AD-A013659) Avail: NTIS CSCL 17/9

An IF amplifier and detector were designed for a noncoherent MTI radar. The amplifier was designed to satisfy the following two requirements: (A) The amplifier must not overload; saturation due to large signals is not permitted. (B) When strong clutter is present, the amplifier must amplify the peak of the signal, since the effects due to small moving targets are carried in the peak of the resultant signal. The performance of the AN/UPS-1 air search radar, operated as a noncoherent MTI system with the modified IF amplifier, was checked. This modification provides increased sensitivity for the noncoherent MTI radar over a radar employing a logarithmic IF amplifier. The advantage of noncoherent MTI is its simplicity. It is therefore attractive for those applications where space and weight are limited. It is also attractive for airborne applications since no compensation is required for radar motion. Author (GRA)

**N76-14353#** ITT Electro-Physics Labs., Inc., Columbia, Md.
**TRACKER STUDIES Final Report, Feb.-Dec. 1974**
R. N. DeWitt Jun. 1975 145 p refs
(Contract N00014-74-C-0106; RF12141001)
(AD-A013648; ITT-EPL-278; CB-115) Avail: NTIS CSCL 17/9

The existence of multi-mode propagation can have two deleterious effects on an OTH radar tracker; it can lead to ambiguity in the interpretation of the range of detected targets, and it can lead to difficulties in determining from a single detection sample; any testing to determine mode identity must be performed at or beyond the tracker. Three methods are considered for identifying propagation modes; one based on testing for the occurrences of echoes in regions or combinations of regions of the radar-observable space accessible to only a single propagation mode, another based on the amplitude fluctuations observed on echoes, and a third in which mode separations are tracked and taken into account. Predictive filters are given general treatment. The Kalman filter tracking algorithm is discussed with the modifications required to implement the first and third (above) mode-identification techniques. The use of signal strength fluctuations as a mode-identification criterion is examined and dismissed as being insufficiently predictable to provide a reliable means for identifying propagation modes. GRA

**N76-14354#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**IMPROVEMENT IN SHORT WAVE FADE DETECTION Air Force Surveys in Geophysics.**
David N. Gaunt 8 May 1975 17 p refs
(AD-A013787; AFCRL-TR-75-0262; AFCRL-AFSG-310) Avail: NTIS CSCL 17/2

Certain types of solar emission produce changes in the ionosphere (identified by Short Wave Fades (SWF)) that adversely affect the efficiency of radio communications. The detection of SWF is in principle a relatively simple approach to the measurement of ionospheric changes and the causative solar emissions. In practice, however, numerous factors may compromise the value of SWF data. An improved Short Wave Fade detection system is described which by techniques of frequency sweeping, reduction of unwanted signals by clipping, and enhancement of desired information by integration makes reliable, quantitative, absorption, and spectral information possible. GRA

**N76-14355#** Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
**SYMRAP: A SYMBOLIC RELIABILITY ANALYSIS PROGRAM**
P. M. Lin, B. J. Leon, and C. Lisboa May 1975 244 p refs
(Contract F30602-72-C-0438; AF Proj. 9567)
(AD-A013730; RADC-TR-75-136) Avail: NTIS CSCL 17/2

This report describes the major contribution of a research effort to identify methods to be used regarding the collection and processing of data which are required for system control of a switched digital integrated communication network. At the early stages of the effort it was discovered that decisions on data collection could not be made until a good network analysis algorithm was devised. One of the major items needed in the analysis was a fast algorithm for computing terminal-pair reliability for a probabilistic graph. This report describes the algorithm developed as well as presenting a documented computer codes with users manual and examples. The body of the report is written for one who has some familiarity with communications network theory and probabilistic graphs. GRA

**N76-14356#** Army Electronics Command, Fort Monmouth, N.J.
**A REPACKAGING OF THE AN/PRR-9 AND AN/PRT-4A AS A TRANSCEIVER**
George R. Oliva, Jr. and Glenn S. Williman Aug. 1975 40 p
(AD-A013865; ECOM-4347) Avail: NTIS CSCL 17/2

This report describes the development and laboratory testing of a repackaged, hand-held transceiver configuration of the AN/PRR-9 and AN/PRT-4A squad radios. Packaging the receiver and transmitter as a single unit provides an alternative to a new development effort for the squad radio requirement. The chief advantages to this approach are a low cost, and near time solution as compared to a new development effort. Major areas of this repackaging effort are development of an efficient voltage regulator to power the receiver; measurements to determine the suitability of single antenna operation; and a switching scheme between receiving and transmitting. Author (GRA)

**N76-14357#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**IONOSPHERIC LIMITATIONS ON RADAR ACCURACY AT L-BAND**
Ronald H. Wand 27 May 1975 83 p refs

(Contract F19628-73-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A013731; TN-1975-28; ESD-TR-75-175) Avail: NTIS CSCL 17/9

For a long-range radar system the target range and bearing, as well as the signal amplitude and phase, are altered to some degree by the presence of the earth's atmosphere and ionosphere. The irregular nature of the ionosphere controls the extent to which these errors can be predicted and compensated for. The limits on radar metric accuracy imposed by ionospheric propagation effects are evaluated with emphasis on an L-band radar situated near the auroral zone. Many of the results are derived from previous progagation studies conducted at the Millstone Hill radar facility by applying appropriate frequency scaling laws. Estimates are made of elevation and range errors associated with the ambient ionosphere and with large-scale ionospheric structures (such as the mid-latitude electron density trough and traveling ionospheric disturbances). The amplitude and angle-of-arrival fluctuations produced by ionospheric scintillation are considered and models constructed which are applicable for normal ionospheric conditions and also for periods of severe geomagnetic disturbance. GRA

**N76-14358#** Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
**APPLICATION OF 0-1 INTEGER PROGRAMMING TO A TRACK ASSEMBLY PROGRAM**
C. L. Morefield 16 Apr. 1975 26 p
(Contract F04701-74-C-0075)
(AD-A013765; TR-0075(5085-10)-1; SAMSO-TR-75-186) Avail: NTIS CSCL 17/9

Multiple-target tracking in high target density situations can be posed as a multi-hypothesis decision problem. The complete solution of such problems on a real time basis requires that the computations be carried out in a computer-efficient manner. This paper discusses a formulation of the tracking problem based on 0-1 integer programming. Such a formulation can markedly reduce computer time requirements. GRA

**N76-14359#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**EVALUATION OF PROBABILITY OF DETECTION FOR SEVERAL TARGET FLUCTUATION MODELS**
David A. Shnidman 8 Jul. 1975 80 p
(Contract F19628-76-C-0002; AF Proj. 2027)
(AD-A013733; TN-1975-35; ESD-TR-75-109) Avail: NTIS CSCL 17/9

Highly efficient algorithms have been derived for calculating the probability of detection, P sub D, for several target fluctuation models. These include the Marcum model (constant target cross section) and the four Swerling models (chi-squared fluctuations). Programs are presented in computer free notation as well as FORTRAN (for accuracies of 0.000001 and 10 to the minus 12 power) for each of the models. In addition, an approximate expression for the elevation of P sub D, applicable when the target return is constant during a scan but exhibits log-normal fluctuation from scan-to-scan, is presented, together with a listing of a FORTRAN program that evaluates the expression. An efficient iterative routine for the determination of the threshold from the probability of false alarm is also included. GRA

**N76-14360#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**THE ARIES PROGRAM: ANALYSIS AND GENERATION OF SIMULATED RADAR MEASUREMENT**
James L. Mannos and Joseph L. Katz 9 Jul. 1975 91 p refs
(Contract F19628-76-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A013734; TN-1975-16; ESD-TR-75-222) Avail: NTIS CSCL 17/9

The report describes the modeling of measurement errors in precision, long range tracking radars due to the combination of environmental effects and variations in target cross section. The environmental effects considered are tropospheric and ionospheric refraction and time delay, ionospheric scintillation, and multipath through the sidelobes at low tracking angles. In addition, radar errors due to thermal and galactic noise, equipment jitter, and bias are included. Six-degree-of-freedom vehicle dynamics are modeled to realistically represent the changing radar cross section due to target dynamics such as tumbling and precession. GRA

**N76-14361#** Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
**OPTIMUM RECEPTION IN AN IMPULSIVE INTERFERENCE ENVIRONMENT**
A. D. Spaulding and David Middleton Jun. 1975 212 p refs
(COM-75-11097/3; OTR-75-67) Avail: NTIS HC $7.75; HC also available from SOD CSCL 17B

An evaluation is presented of the performance of both optimum and conventional receivers in a broad class of (mostly man-made) electromagnetic interference. Specifically, class A interference is considered, where standard digital signal communications, both coherently and incoherently received, are employed. The results obtained provide structures of optimum signal processors in class A EM environments, and performance bounds for such processors and performance estimates for similar, conventional receivers for the same communication tasks. GRA

**N76-14362#** Office of Telecommunications, Boulder, Colo. Inst. for Telecommunication Sciences.
**ATMOSPHERIC CONSIDERATIONS IN RADIO SYSTEM ENGINEERING AT 10 TO 30 GHz**
C. A. Samson Jun. 1975 72 p refs
(COM-75-11095/7; OTR-75-66) Avail: NTIS HC $4.50; HC also available from SOD CSCL 17B

The effects of the atmosphere on radio propagation at frequencies of 10 GHz to 30 GHz include attenuation and depolarization by precipitation, absorption by water vapor and oxygen, and multipath fading related to refractivity gradients in stratified layers. Information is presented on the probable magnitude of the various weather-related effects, considering the differences in radio frequency, geographical location, and climate. The limitations of climatological data are discussed, as well as methods of using the available data in system engineering. GRA

**N76-14363#** National Bureau of Standards, Washington, D.C. Engineering and Product Standards Div.
**TAMPER-RESISTANT TELEVISION SURVEILLANCE SYSTEM Final Report**
Owen B. Laug and Kenneth W. Yee May 1975 39 p refs
(Contract ACDA/RA-126)
(COM-75-11017/1; NBSIR-75-707) Avail: NTIS HC $4.00 CSCL 17B

This work is part of a joint U.S.-Canada safeguards research program to develop and evaluate tamper-resistant, tamper-indicating techniques and instrumentation that might be applicable in safeguarding reactors or other nuclear facilities. The principal design objectives are to provide a system capable of unattended operation, data storage capacity for a period up to 90 days, and resistance to deception by insertion of false video information on the transmission line or substitution of false scenes in the camera's field of view. These objectives are accomplished by utilizing commercial high-resolution closed-circuit TV and photography coupled with a video encoding technique which permutes the luminance signal in a different pattern for each recorded picture. GRA

**N76-14364#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**EFFECTS OF LOCAL TERRAIN AND OBSTACLES UPON NEAR HORIZON GAIN OF L-BAND BEACON ANTENNAS**
Alex Spiridon 17 Jul. 1975 95 p refs
(Contracts DOT-FA72WAI-261; F19628-76-C-0002; FAA Proj. 034-241-012)
(AD-A013732; TN-1975-6; ESD-TR-75-224) Avail: NTIS CSCL 09/5

Models are given of the mechanisms that determine the effective gain of an L-band ground based antenna at near horizon elevation angles. Primary emphasis is given to the environment of typical Air Traffic Control Radar Beacon System (ATCRBS) sites. GRA

**N76-14365#** Dikewood Corp., Los Angeles, Calif.
**QUASI-STATIC MAGNETIC FIELD PENETRATION INTO A HEMISPHERICAL INDENTATION IN AN INFINITE CONDUCTING PLANE Final Report, 28 Sep. 1973 - 24 Jul. 1974**
John Lam Kirtland AFB, New Mex. AFWL Jul. 1975 36 p refs
(Contract F29601-74-C-0010; AF Proj. 3763)

(AD-A013851; AFWL-TR-74-249) Avail: NTIS CSCL 20/14

The problem of the penetration of a quasi-static magnetic field into a hemispherical indentation in an infinite conducting plane is formulated as an integral equation and solved numerically to a high degree of accuracy. The results are directly applicable to the study of a large class of aircraft antennas, such as the marker beacon antenna. The value of the magnetic potential inside the cavity, the induced magnetic dipole moment, and the magnetic flux passing through a receiving loop antenna erected in the cavity are calculated. GRA

**N76-14366#** Dikewood Corp., Los Angeles, Calif.
**EXACT SOLUTION OF THE PROBLEM OF QUASI-STATIC ELECTRIC FIELD PENETRATION INTO A HEMISPHERICAL INDENTATION IN AN INFINITE CONDUCTING PLANE Final Report, 28 Sep. 1973 - 24 Jul. 1974**
John Lam Kirtland AFB, New Mex. AFWL Jul. 1975 32 p refs
(Contract F29601-74-C-0010; AF Proj. 3763)
(AD-A013850; AFWL-TR-74-248) Avail: NTIS CSCL 20/14

The problem of the penetration of a quasi-static electric field into a hemispherical indentation in an infinite conducting plane is solved exactly. The results are directly applicable to the study of a large class of aircraft antennas; for example, the marker beacon antenna. The solution is obtained by an inversion transformation on the known solution for the problem of a conducting right-angled wedge excited by an electric dipole. A closed form for the electrostatic potential is derived. The value of the potential, the electric surface charge density, the induced dipole moment of the cavity, and the averaged electric field over the length of a thinwire stub antenna erected from the cavity bottom are calculated. It is found that the penetration electric field strength at the cavity bottom is about 10 percent of that of the external field, while the averaged field on the symmetry axis varies from 10 to 28 percent. GRA

**N76-14367#** Tetra Tech, Inc., Pasadena, Calif.
**ANALYTICAL AND NUMERICAL EMP COUPLING SOLUTIONS FOR A CLASS OF STRUCTURES ATTACHED TO THE WING OF AN AIRCRAFT Final Report, Jun. 1974 - Sep. 1974**
M. I. Sancer and A. D. Varvatsis Jul. 1975 130 p refs
(Contract F29601-74-C-0120; AF Proj. 3763)
(AD-A013775; AFWL-TR-74-298) Avail: NTIS CSCL 20/14

A description is presented on the analysis necessary to develop a large EMP coupling computer code. The analysis for two models of the wing is contained in this note; however, the code was only developed for the simpler wing model. The code calculates EMP-induced surface current densities on the attached structure as well as aperture-excited voltages and currents on a cable or cable bundle that is interior to the circular cylindrical portion of the structure. Also contained in the code is an option to isolate the circular cylinder and to calculate new numerical results for this well studied and useful model. GRA

**N76-14300*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Elements Research Section.
**S-BAND ZERO-DELAY DEVICE MULTIPATH TESTS ON THE 64-METER ANTENNA AT DSS 43, DSS 63, AND DSS 14**
T. Y Otoshi *In its* The Deep Space Network 15 Oct. 1975 p 20-32 refs (For availability see N76-14296 05-31)
CSCL 17B

**N76-14302*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**THE EFFECT OF NOISE AND DIVERSITY ON SYNTHETIC ARRAY RADAR IMAGERY**
S. Butman and R. G. Lipes *In its* The Deep Space Network 15 Oct. 1975 p 46-53 refs (For availability see N76-14296 05-31)
CSCL 17I

**N76-14305*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. RF Systems Development Section.
**RF AUTOMATION DEMONSTRATION, TRANSMITTER AUTOMATION, AND AUTOMATIC MICROWAVE CONFIGURATION CONTROL**
R. B. Crow, R. M. Gosline, and J. G. Leflang *In its* The Deep Space Network 15 Oct. 1975 p 66-79 refs (For availability see N76-14296 05-31)
CSCL 17B

**N76-14307*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**RADAR RANGING OF THE PLANET MARS AT 8495 MHz**
G. S. Downs and P. E. Reichley *In its* The Deep Space Network 15 Oct. 1975 p 95-106 refs (For availability see N76-14296 05-31)
CSCL 17I

**N76-14309*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Network Operations Office.
**PSEUDO-DRVID: A NEW TECHNIQUE FOR NEAR-REAL-TIME VALIDATION OF RANGING SYSTEM DATA**
A. L. Berman *In its* The Deep Space Network 15 Oct. 1975 p 180-187 refs (For availability see N76-14296 05-31)
CSCL 17B

# 33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

**N76-14368** British Library Lending Div., Boston Spa (England).
**RESISTANCE TO RADIATION OF THE HIGH-VOLTAGE INSULATION OF ELECTRICAL MACHINES**
K. Rohmer and K. Sperling [1974] 14 p refs Transl. into ENGLISH from Atom und Strom (West Germany), no. 9/10, Sep./Oct. 1974 p 108-111
(BLL-CE-Trans-6747-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The functions and importance of electrical machines within the safety containment of nuclear power stations are summarized. Details are given on the radioactive radiation occuring inside the safety containment and its effect on the service life of the insulation. The chemicophysical processes occuring as a result of radiation are explained and reference is made to radiation resistant insulating materials. Author

**N76-14369** British Library Lending Div., Boston Spa (England).
**BACKSPUTTERING: A NEW TECHNIQUE FOR THE PRODUCTION OF MAXIMUM RELIABILITY SEMICONDUCTOR CONTACTS FOR SHF TRANSISTORS**
H. Glaswichnig, K. Hoerschelmann, and H. Weidlich 12 Sep. 1975 14 p refs Transl. into ENGLISH from Siemens Forschungs- und Entwicklungsber. (Berlin), v. 3, no. 6, 1974 p 384-389 (BLL-Trans-3253-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.

Attempts made to produce bipolar microwave transistors with high transit frequency, low base resistance, and low collector and base capacitance are reported. The shapping and metallizing process and line width requirements are discussed. Author

**N76-14370** Arizona State Univ., Tempe.
**THIN FILM TRANSISTORS (TFTs) AND THEIR APPLICATION TO A HYBRID FLAT DISPLAY SYSTEM Ph.D. Thesis**
Hasan Ilhan Refioglu 1975 180 p
Avail: Univ. Microfilms Order No. 75-28490

A hybrid flat display system is reported which is a relatively shallow, matrix image display tube that is capable of producing displays comparable in quality to those obtainable with conventional cathode ray tubes or other flat displays. Special emphasis is given to the analysis, design and fabrication of Thin Film Transistors (TFTs). The performance requirements imposed on the TFT devices as dictated by the operational requirements of the display panel, operating at conventional TV rates are discussed. Contributions to the theory of TFTs are made by

considering the effect of trap distributions on TFT characteristics. Dissert. Abstr.

**N76-14371*** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

**COMPACT-BI-PHASE PULSE CODED MODULATION DECODER Patent**

Pierce C. Toole, inventor (to NASA) Issued 28 Oct. 1975 4 p Filed 26 Dec. 1974

(NASA-Case-KSC-10834-1; US-Patent-3,916,084; US-Patent-Appl-SN-536535; US-Patent-Class-178-69.5R; US-Patent-Class-178-88; US-Patent-Class-328-63; US-Patent-Class-328-190) Avail: US Patent Office CSCL 09A

An apparatus is described for extracting and generating a clock pulse train from a pulse coded data train. The apparatus includes a filter circuit for receiving the pulse coded data train, and a first set-reset flip-flop is provided for receiving the signals from the pulse coded train. Coupled to the output of the first flip-flop is a means for generating a triggering pulse responsive to the occurrence of data within the train. A pulse gate is activated by the triggering pulse for causing the data from the pulse coded data train to be stored in a second flip-flop. A clock pulse generating means is coupled between the outputs of the first and second flip-flops for generating a continuous stream of clock pulses which are synchronized with the incoming-pulse coded data train. Official Gazette of the U.S. Patent Office

**N76-14372*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

**TURNSTILE AND FLARED CONE UHF ANTENNA Patent**

Donald J. Bottoms (Martin Marietta Corp., Denver) and Theofanis G. Gavrillis, inventors (to NASA) (Martin Marietta Corp., Denver) Issued 11 Nov. 1975 5 p Filed 27 Nov. 1974 Supersedes N75-13125 (13 - 04, p 0405) Sponsored by NASA

(NASA-Case-LAR-10970-1; US-Patent-3,919,710; US-Patent-Appl-SN-527790; US-Patent-Class-343-770; US-Patent-Class-343-797; US-Patent-Class-343-846) Avail: US Patent Office CSCL 09C

An improvement to the turnstile-cup antenna is described which increases its beamwidth. The improved beamwidth characteristics are attained by tilting the turnstile arms toward slots contained in a truncated cone.

Official Gazette of the U.S. Patent Office

**N76-14373*** National Aeronautics and Space Administration. Pasadena Office, Calif.

**NONLINEAR NONSINGULAR FEEDBACK SHIFT REGISTERS Patent**

Martin Perlman, inventor (to NASA) (JPL) Issued 7 Oct. 1975 18 p Filed 27 Aug. 1974 Supersedes N74-32648 (12 - 22, p 2663) Sponsored by NASA

(NASA-Case-NPO-13451-1; US-Patent-3,911,330; US-Patent-Appl-SN-501012; US-Patent-Class-328-37; US-Patent-Class-307-221R; US-Patent-Class-235-92SH) Avail: US Patent Office CSCL 09C

Four classes of nonlinear nonsingular feedback shift registers (NLFSR) are disclosed. Each NLFSR is assumed to be r stages long and regardless of its class, generates a feedback sequence of length 2r. Each NLFSR of either class 1 or class 2 has a feedback arrangement which is a function of a primative polynomial of degree r-1. Each register of class 1 includes three nonlinear terms, each one of which is the AND function of a different combination of (r-1) outputs of the first (r-1) stages. Each register of class 2 includes a single nonlinear term which is the AND function of (r-1) outputs of the first (r-1) stages. Each NLFSR in class 3 has a feedback arrangement which is based on a primative polynomial of degree r-2 and a unique single nonlinear term, while each NLFSR in class 4 has a feedback arrangement which is based on a primitive polynomial of degree r-3 and three nonlinear terms.

Official Gazette of the U.S. Patent Office

**N76-14374#** Research Inst. of National Defence, Stockholm (Sweden).

**PRESENT POSITION AND PROGNOSIS FOR FT ELEMENT PERFORMANCE WITHIN THE MICROWAVE AREA FOR 1970 - 1985 [NULAEGE OCH PROGNOS FOER FT-ELEMENTS PRESTANDA INOM MIKROVAGSOMRADET 1970 - 1985. TILLAEGG OCH KOMMENTARER TILL FOA 3 RAPPORT A 3751-E8]**

Bertil Peterson Feb. 1974 31 p refs In SWEDISH Addendum to comments in FOA3 report A37-51-E-8

(FOA-3-C-3778-E8-Add) Avail: NTIS HC $4.00

A prognosis of FT elements performance within the microwave area for 1985 was sent to some nine research institutions and industries and is presented here in revised form. Alterations have been made in line with critics and commentators from these organizations, and in addition, the latest developments have been taken into account. Author

**N76-14375*#** Hughes Aircraft Co., Culver City, Calif. Aerospace Groups.

**CONTAMINATION CONTROL IN HYBRID MICROELECTRONIC MODULES. PART 1: IDENTIFICATION OF CRITICAL PROCESS AND CONTAMINANTS Final Report, May 1974 - Apr. 1975**

R. P. Himmel Apr. 1975 42 p refs

(Contract NAS8-30876)

(NASA-CR-144101; P75-111-Pt-1) Avail: NTIS HC $4.00 CSCL 09C

Various hybrid processing steps, handling procedures, and materials are examined in an attempt to identify sources of contamination and to propose methods for the control of these contaminants. It is found that package sealing, assembly, and rework are especially susceptible to contamination. Moisture and loose particles are identified as the worst contaminants. The points at which contaminants are most likely to enter the hybrid package are also identified, and both general and specific methods for their detection and control are developed. In general, the most effective controls for contaminants are: clean working areas, visual inspection at each step of the process, and effective cleaning at critical process steps. Specific methods suggested include the detection of loose particles by a precap visual inspection, by preseal and post-seal electrical testing, and by a particle impact noise test. Moisture is best controlled by sealing all packages in a clean, dry, inert atmosphere after a thorough bake-out of all parts. Author

**N76-14376*#** Hughes Aircraft Co., Culver City, Calif. Aerospace Groups.

**CONTAMINATION CONTROL IN HYBRID MICROELECTRONIC MODULES. PART 2: SELECTION AND EVALUATION OF COATING MATERIALS Final Report, May 1974 - Apr. 1975**

R. P. Himmel Apr. 1975 77 p refs

(Contract NAS8-30876)

(NASA-CR-144102; P75-111-Pt-2) Avail: NTIS HC $5.00 CSCL 09C

The selection, test, and evaluation of organic coating materials for contamination control in hybrid circuits is reported. The coatings were evaluated to determine their suitability for use as a conformal coating over the hybrid microcircuit (including chips and wire bonds) inside a hermetically sealed package. Evaluations included ease of coating application and repair and effect on thin film and thick film resistors, beam leads, wire bonds, transistor chips, and capacitor chips. The coatings were also tested for such properties as insulation resistance, voltage breakdown strength, and capability of immobilizing loose particles inside the packages. The selected coatings were found to be electrically, mechanically, and chemically compatible with all components and materials normally used in hybrid microcircuits. Author

**N76-14377*#** Hughes Aircraft Co., Culver City, Calif. Aerospace Groups.

**CONTAMINATION CONTROL IN HYBRID MICROELECTRONIC MODULES. PART 3: SPECIFICATIONS FOR COATING MATERIAL AND PROCESS CONTROLS Final Report, May 1974 - Apr. 1975**

R. P. Himmel Apr. 1975 43 p

(Contract NAS8-30876)

(NASA-CR-144103; P75-111-Pt-3) Avail: NTIS HC $4.00 CSCL 09C

Resin systems for coating hybrids prior to hermetic sealing are described. The resin systems are a flexible silicone junction resin system and a flexible cycloaliphatic epoxy resin system.

The coatings are intended for application to the hybrid after all the chips have been assembled and wire bonded, but prior to hermetic sealing of the package. The purpose of the coating is to control particulate contamination by immobilizing particles and by passivating the hybrid. Recommended process controls for the purpose of minimizing contamination in hybrid microcircuit packages are given. Emphasis is placed on those critical hybrid processing steps in which contamination is most likely to occur. Author

**N76-14378*#** Scientific Translation Service, Santa Barbara, Calif.
**RELATION BETWEEN EFFICIENCY AND RANGE OF ELECTRIC VEHICLES**
Udo Goerlach Washington NASA Dec. 1975 16 p refs Transl. into ENGLISH from Elektrotech. Z. Ausg. A (USSR), v. 94, no. 11, Nov. 1973 p 632-636
(Contract NASw-2791)
(NASA-TT-F-16820) Avail: NTIS HC $3.50 CSCL 09C

A method is described for replacing the electric drive unit of an electric road vehicle by an electrical replacement diagram, including the mechanical parameters. A system of equations is derived for the system which allows analyzing on a computer. Drive units are built up of components and easily analyzed to determine losses and efficiencies. Practical examples are discussed. Author

**N76-14379*#** Kanner (Leo) Associates, Redwood City, Calif.
**ELECTRIC PROPULSION FOR ROAD VEHICLES: STATE OF THE ART AND PROBLEMS**
C. Bader and H. G. Plust Washington NASA Dec. 1975 27 p refs Transl. into ENGLISH from Elektrotech. Z. Ausg. A (West Ger.), v. 94, no. 11, Nov. 1973 p 637-645
(Contract NASw-2790)
(NASA-TT-F-16819) Avail: NTIS HC $4.00 CSCL 09C

An analysis of various electrical and hybrid electrical drives shows that the only practical power supply for electrical vehicles is the lead battery. In the future, alkaline and high-temperature storage batteries may become more important, since the operating costs of vehicles equipped with these devices may be more favorable under certain circumstances. Optimization of the electrical propulsion system for a road vehicle presently consists in minimizing the weight of the energy storage unit required to satisfy the prescribed transport jobs and in exploiting as completely as possible the limited energy storage capacity. Author

**N76-14380*#** California Univ., Berkeley. Dept. of Physics.
**OPERATION OF THE SUPARAMP AT 33GHz**
R. Y. Chiao and P. T. Parrish [1975] 28 p refs
(Grants NGL-05-003-272; NSF AST-72-05136)
(NASA-CR-145983) Avail: NTIS HC $4.00 CSCL 09A

A 9mm degenerate parametric amplifier was constructed using a linear, series array of unbiased Josephson junctions as the active, nonlinear element. A balanced diode mixer was used as a synchronous detector, with a single source serving both as the pump and as the mixer local oscillator. A stable, net gain of 15 dB in an instantaneous bandwith (FWHM) of 3.4 GHz was achieved. A system noise temperature of 220 K + or - 5 K (DSB) was measured with a SUPARAMP contribution of only 20 K x or - 10 K. Output saturation was observed and complicates the interpretation of the noise temperature measurements and may render them upper limits. A comparison was made with the results of an earlier 3 cm suparamp. The data is in substantial agreement with theoretical predictions. Author

**N76-14381#** AEG-Telefunken, Heilbronn (West Germany). Fachbereich Halbleiter.
**CUSTOM DESIGN IN COMPLEMENTARY MOS TECHNOLOGY Final Report [MOS-KUNDENSCHALTUNGEN IN KOMPLEMENTAER-MOS-TECHNOLOGIE]**
Kamal Merchant, Gottfried Kronberger, and Paul Sieber Bonn Bundesmin. fuer Forsch. u. Technol. Apr. 1975 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-08) Avail: NTIS HC $4.00; ZLDI, Munich DM 8.40

THe approximation used for the current-voltage relationship of a MOS semiconductor by the analysis program DYMOS is not accurate enough for an N-channel complementary MOS technology transistor. The theoretical saturation voltage is twice as large as experimentally observed - introducing a saturation constant gamma in the equation UDSAT=gamma Ugt (Ugt being a function of gate voltage Ug and threshold voltage Ut); one can fit with a sufficient accuracy the current-voltage characteristics of a MOS transistor to the experiment. The linear dependence of saturation voltage from Ugt was examined, and a theoretical interpretation of the saturation constant is given as well as its dependence on the applied technology. ESA

**N76-14382#** Watkins-Johnson Co., Palo Alto, Calif.
**ELECTRON BEAM SEMICONDUCTOR S-BAND AMPLIFIER Interim Report, 1 Apr. - 31 May 1974**
J. A. Long May 1975 32 p refs
(Contract DAAB07-72-C-0220; DA Proj. 1S7-62705-AH-94)
(AD-A013421; W-J-22-4102; ECOM-72-0220-6; IR-6) Avail: NTIS CSCL 09/5

During this period an improved meander line, deflection structure was fabricated and incorporated into a phosphor-screen, beam tester. It was tested and the measured beam deflection sensitivity is presented. Author (GRA)

**N76-14383#** Cincinnati Electronics Corp., Ohio.
**ELECTRONICALLY CONTROLLED FILTERS AND MULTICOUPLERS Interim Report, 1 Mar. 1974 - 1 Mar. 1975**
C. M. Morris and D. Laws Jul. 1975 46 p
(Contract DAAB07-73-C-0218)
(AD-A013499; ECOM-73-0218-2; IR-2) Avail: NTIS CSCL 09/5

This report covers the 2nd period of the program and describes the design, fabrication and test of 3 Electronically Tunable Filters. These filters cover the frequency range of 30-80 MHz at an RF power level of 25 watts. The primary application of the filter is to use at the output of an FM Radio to help reduce the transmitter noise floor. A description of the design requirements are given, a system description provided test data presented on the three filters, and recommendations for improvements in future models discussed. Author (GRA)

**N76-14384#** Sprague Electric Co., North Adams, Mass.
**PRODUCTION ENGINEERING MEASURE FOR IMPROVED RELIABILITY OF METALLIZED POLYCARBONATE CAPACITORS Quarterly Report, 1 Aug. - 31 Oct. 1974**
Leonard Adelson and H. G. Brandt Nov. 1974 18 p
(Contract DAAB05-67-C-2707)
(AD-A014068; QR-29) Avail: NTIS CSCL 09/1

The object of the production engineering measure is to improve production techniques for the manufacture of Metallized Polycarbonate and Metallized Polysulfone Capacitors to attain a maximum failure rate of 0.001% per 1000 hours with a 90% confidence level. The 11,550 Polysulfone Capacitors of the First Production Run completed the 10,000 hour Extended Life Test at -125C and at rated voltage in accordance with Specifications. GRA

**N76-14385#** Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
**PROGRAMMABLE ACOUSTIC SURFACE WAVE TRAPPED DELAY LINES/MATCHED FILTERS Final Report**
P. J. Hagon and R. N. Seymour Jul. 1975 22 p refs
(Contract N00014-74-C-0457)
(AD-A014086; C74-1043/501) Avail: NTIS CSCL 09/1

The design, fabrication and performance of three programmable 32/64/128 acoustic surface wave tapped delay line matched filters are described. The devices were temperature stable ST cut quartz tapped delay lines in combination with silicon on sapphire integrated control circuit and external switches to allow correlation of spread spectrum biphase coded waveforms of 32, 64, and 128 chips at a 70 MHz IF frequency with 10 MHz chip rate. GRA

**N76-14386#** Rockwell International Corp., Anaheim, Calif. Autonetics Group.
**EVALUATION OF DISCRETE SEMICONDUCTOR SPECIFICATIONS. VOLUME 3: SEMICONDUCTOR DEVICES-TESTS-CATEGORY MATRIX Final Report, Mar. - Nov. 1974**
Arnold H. Fanzoi and Donald E. Brown Jun. 1975 553 p refs

(Contract F30602-74-C-0149)
(AD-A013924; RADC-TR-75-154-Vol-3) Avail: NTIS CSCL 09/1

The prescribed methodology for this program is through analysis of the detail specifications with recommendations for advancing requirements for technical evaluation including recommended quality and reliability. Approximately 90 detail specifications covering recommended semiconductor devices have been technically documented. Additional quality and reliability documents to support these specifications are proposed and included. These include advanced controls to assure more satisfactory devices with recommendations for supporting manuals to assist in uniform implementation. A survey of various military projects preferred parts, those chosen for new design and review of information from other sources was made. Discussion with the controlling office provided the basis for study of the detailed devices and appropriate characteristics. GRA

**N76-14387#** Radio Corp. of America, Burlington, Mass. Government Communications and Automated Systems Div.
**MANUFACTURING METHODS AND TECHNOLOGY PROGRAM AUTOMATED IMAGE DEVICE EVALUATOR (AIDE) Quarterly Progress Report, 1 Jan. - 31 Mar. 1975**
E. W. Ketler 31 Mar. 1975 38 p refs
(Contract DAAB05-74-C-2524)
(AD-A014064; QPR-5) Avail: NTIS CSCL 09/1

The purpose of the work is to establish a manufacturing method and technology program for Automated Image Device Evaluator (AIDE) which will provide a computer controlled test system capable of performing production acceptance testing of second generation image intensifier tubes at the manufacturer's plant. The report covers the work performed on the AIDE equipment task during the period 1 January - 31 March 1975. It presents a technical and physical description of the Development Model equipment design and configuration. The work accomplished during the quarter and the task schedules are also presented. GRA

**N76-14388#** Princeton Univ., N.J. Dept. of Electrical Engineering.
**STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS Semiannual Report**
Walter C. Johnson Jan. 1975 22 p refs
(Contract F19628-72-C-0298; ARPA Order 2180)
(AD-A013935; AFCRL-TR-75-0157; SATR-5) Avail: NTIS CSCL 09/1

An overview is given of progress in the study of high-field electronic transport and dielectric breakdown in thin (1000-5000 A) insulating films on silicon. The principal results to date are on SiO2; also under study are Al2O3, Si3N4, and layered composites. The studies include corona-induced nondestructive breakdown, self-quenched breakdown, effects of electron irradiation, study of charge-carrier trapping, study of lateral nonuniformities, electron-beam probing of the insulator-semiconductor interface, and theoretical modeling of hot-electron distributions and of localized breakdown. GRA

**N76-14389#** Dikewood Corp., Los Angeles, Calif. Research Branch.
**IMPEDANCES AND FIELD DISTRIBUTIONS OF TWO COPLANAR PARALLEL PERFECTLY CONDUCTING STRIPS WITH ARBITRARY WIDTHS Final Report, 29 May - 20 Oct. 1974**
Tom K. Liu Jul. 1975 50 p refs
(Contract F29601-74-C-0010; AF Proj. 3763)
(AD-A013857; AFWL-TR-74-290) Avail: NTIS CSCL 09/1

Transmission lines in the form of two coplanar parallel conducting strips with arbitrary widths are studied. This kind of coplanar strip line finds application in many aircraft antennas. The geometrical impedance factor, which relates the characteristic impedance of the transmission line to the intrinsic impedance of the medium surrounding the strips, is plotted and tabulated. The field distributions of the strips are also plotted. Compared to a two-cylinder transmission line with the radii of the cylinders being equal to the strip widths and the cylinders being separated by the same distance as the strips, the geometrical impedance factor of the strips is larger than that of the cylinders by approximately a constant (ln 2)/pi. GRA

**N76-14390#** National Bureau of Standards, Washington, D.C. Electricity Div.
**A STUDY OF AIR-GAP BREAKDOWN AT 28.5 KILOHERTZ Final Report**
F. Ralph Kotter 20 Jun. 1975 43 p refs
(Contract N00039-3316-7105)
(COM-75-11071/8; NBSIR-75-731) Avail: NTIS HC $4.00 CSCL 09A

Measurements of the electrical breakdown of both quasi-uniform and highly nonuniform-field air gaps at a frequency of 28.5 kHz are reported. Gaps between a variety of electrode geometries ranges from a few centimeters to over two meters in length. Breakdown voltages significantly below the corresponding 60 Hz values were observed with electrodes for which appreciable pre-breakdown discharges occurred, and a pattern of 'anomalous' flashovers at considerably lower than the normal breakdown voltages was noted with quasi-uniform field gaps. The results obtained appear to correlate well with the data found in the literature for higher frequencies but lower voltages. On the basis of the gap behavior observed, a prototype protective gas system designed for application to the tower base insulator assembly of a VLF (15 to 30 kHz) radio transmitter was tested and found satisfactory. GRA

**N76-14391#** Texas Univ., Austin. Electronics Research Center.
**TEXAS BIANNUAL OF ELECTRONICS RESEARCH NUMBER 21 Summary Report, 1 Oct. 1974 - 31 Mar. 1975**
Arwin A. Dougal 15 May 1975 316 p refs
(Contract F44620-71-C-0091)
(AD-A013816; AFOSR-75-1147TR) Avail: NTIS CSCL 09/3

This Twenty-First Biannual includes recent findings, research investigations, progress reports and future plans in the areas of Solid State Electronics, Information Systems, Plasma and Quantum Electronics, Bio-Medical Electronics, and Acoustics and Radio Sciences. GRA

**N76-14392#** Sprague Electric Co., North Adams, Mass. Semiconductor Div.
**PRODUCTION ENGINEERING MEASURE FOR HYBRID CIRCUITS FOR FUZE APPLICATIONS. VOLUME 3: QUALITY CONTROL MANUAL Final Report, 26 Jun. 1971 - 7 Nov. 1974**
G. H. Tully 7 Nov. 1974 151 p
(Contract DAAB05-71-C-2642)
(AD-A014081) Avail: NTIS CSCL 09/5

The manual outlines the methods and procedures of the Quality Assurance and Reliability (QAR) Department of the Sprague Electric Company, Integrated Circuit Division, located at Worcester, Massachusetts. The manual describes the techniques used by the QAR Department to monitor product quality and reliability so the optimum product capability can be obtained. This manual was prepared to meet the requirements and intent of MIL-C-45662, MIL-I-45208, NASA Quality Publication NPC 200-3 and MIL-Q-9858A. GRA

**N76-14393#** Tetra Tech, Inc., Pasadena, Calif.
**MATCHING A PARTICULAR PULSER TO A PARALLEL-PLATE SIMULATOR Final Report, 10 Jul. - 18 Oct. 1974**
R. W. Latham, M. I. Sancer, and A. D. Varvatsis Jul. 1975 63 p refs
(Contract F29601-74-C-0115; AF Proj. 3763)
(AD-A013852; AFWL-TR-74-287) Avail: NTIS CSCL 14/2

As electromagnetic energy source that incorporates the peaking capacitor arms of a Marx generator as part of its electromagnetic configuration is to be used in an Electromagnetic Pulse simulator to be built under the supervision of the Air Force Weapons Laboratory. In this report, the positions of the peaking capacitors that fulfill certain desirable null-flux conditions are determined. The characteristic impedance and several other useful properties of the conical base of the pulser are also calculated. GRA

**N76-14290*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 4: INTEGRATED CIRCUITS**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 86-109 refs (For availability see N76-14286 05-31)
CSCL 09C

**N76-14301*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**CALCULATING ACQUISITION BEHAVIOR FOR COMPLETELY DIGITAL PHASE-LOCKED LOOPS**
J. R. Lesh *In its* The Deep Space Network 15 Oct. 1975 p 33-45 refs (For availability see N76-14296 05-31)
CSCL 09C

# 34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

**N76-14394** Case Western Reserve Univ., Cleveland, Ohio.
**STUDY OF NON-ISOTHERMAL FLOW AND HEAT TRANSFER IN POROUS MEDIA Ph.D. Thesis**
Bhim Sen Singh 1975 161 p
Avail: Univ. Microfilms Order No. 75-27966

The objective is to find an appropriate set of conservation equations describing the nonisothermal flow and heat transfer in porous media. Careful measurements were made to study the applicability of Darcy's law and the volume averaged energy equation in describing heat transfer and nonisothermal flow of an incompressible fluid in consolidated metallic porous media. Experiments were performed on five different foam metal specimens, three made of nickel 200 and two of copper, having a porosity range of 0.55 to 0.80. Cylindrical specimens of 6 in. nominal length and 2 in. nominal diameter were used with distilled water as the saturating fluid. The permeability of each specimen was measured. The effective thermal conductivity of each specimen fully saturated with water was measured using the steady state method of comparison. The detailed temperature distribution in each specimen was measured with a number of thermal boundary conditions and fluid flow. The pressure drop across the specimen was also measured. Dissert. Abstr.

**N76-14395** Notre Dame Univ., Ind.
**ANALYTICAL STUDY OF RADIATION-CONVECTION INTERACTION OF ABSORBING-EMITTING FLUIDS IN NON-SIMILAR NATURAL CONVECTION BOUNDARY LAYER FLOW Ph.D. Thesis**
Joseph David Bankston, Jr. 1975 191 p
Avail: Univ. Microfilms Order No. 75-27982

Radiation-convection interaction in absorbing-emitting fluids was analytically investigated by the application of the technique of local nonsimilarity. This technique was used to study heat transfer in the natural convection boundary layer about a vertical gray plate. Both a liquid, carbon tetrachloride, and a gas, ammonia, were examined. In each case, the fluids were considered to be nongray, infinite in extent, and the flow laminar. The exponential wide band model for total band absorptances was utilized to obtain numerical solutions for pure ammonia gas for both constant wall temperature and constant wall heat flux boundary conditions. For both boundary conditions, wall emittances of 0, 0.2, 0.5 and 0.8 were studied over a pressure range from 0.1 to 10 bar. The analysis predicted substantial radiation interaction effects, and a peak of the interaction effects with pressure. The constant wall heat flux boundary condition was studied for liquid carbon tetrachloride. The random model of Novotny for the total band absorptance was used in this formulation. Wall emittances of 0, 0.5, and 0.8 are considered. Dissert. Abstr.

**N76-14396** Minnesota Univ., Minneapolis.
**HEAT TRANSFER AND FLUID FLOW IN A SHORT VORTEX CHAMBER Ph.D. Thesis**
Philip Arthur Pfund 1975 258 p
Avail: Univ. Microfilms Order No. 75-27185

A study was conducted to determine if a vortex chamber could be used as a controllable compact heat exchanger. It was concluded from the results that it could be used for such a purpose if the large pressure drops necessary to drive such a device could be tolerated. The particular chamber used in the experimental program had an aspect ratio of 0.0357. The fluid used was air and the mass flow rate of air through the chamber was kept constant. The swirl ratio (the ratio of the mean tangential velocity component to the mean radial velocity component at the entrance) was varied throughout the test. Four swirl ratios (0, 1.0, 3.7, 12.5) were studied. Both of the endwalls were heated electrically to produce surfaces generating uniform heat flux. A quartz-coated hot film probe designed for the test was used to obtain velocity and temperature profiles at four radial locations. The velocity profiles, along with turbulence intensities, were measured both for heated and unheated wall conditions. Dissert. Abstr.

**N76-14397** Arizona Univ., Tucson.
**TURBULENCE STRUCTURE IN GAS FLOWS RELAMINARIZING BY HEATING Ph.D. Thesis**
Kenneth Roy Perkins 1975 220 p
Avail: Univ. Microfilms Order No. 75-26931

Experiments for air flowing in a vertical circular tube are presented for heating rates causing significant property variation. Entering Reynolds numbers vary from 4000 to 8500 with the dimensionless heating parameter varying from 0.001 to 0.0056. Particular attention is paid to internal mean temperature profile data, taken at axial stations from $x/D = 2.9$ to $x/D = 25.5$, in flow regimes ranging from nearly constant properties, turbulent flow to strongly heated, laminarizing flow. The natural convection parameter varied from 0.06 to 0.78 so buoyancy effects may be significant in some runs. All measurements presented are for a 1.08 inch inside diameter, circular duct utilizing resistive heating to approximate a constant heat flux boundary condition. For strongly heated flows, the data show definite increases in the sizes of both the linear sublayer and the viscous sublayer, defined as the regions of dominant viscous effects and noticeable viscous effects, respectively. Both internal profile data and external wall measurements are compared to numerical predictions using variations of the van Driest mixing length model. Dissert. Abstr.

**N76-14398** Michigan State Univ., East Lansing.
**THE INFLUENCE OF HEAT TRANSFER ON THE STABILITY OF PARALLEL FLOW BETWEEN CONCENTRIC CYLINDERS Ph.D. Thesis**
Yung Kook Choo 1975 128 p
Avail: Univ. Microfilms Order No. 75-27250

The stability of parallel flow between concentric cylinders at different temperatures is investigated for infinitesimal velocity and pressure disturbances. Primary interest is in the effect of heat transfer and the radius ratio of the inner to outer cylinder on the critical point of the neutral stability curve. The modified Orr-Sommerfeld equation includes perturbations for the velocity and viscosity as well as its gradient terms, and results in a fourth order ordinary differential equation. This equation and boundary conditions represent an eigenvalue problem that is transformed to an equivalent initial value problem and solved numerically using a fourth order Runge-Kutta integration scheme. The results indicate a strong dependence of the critical eigenvalues on both the heat transfer and the radius ratio a/b of inner to outer cylinder. Heating the inner cylinder destabilizes the flow. Dissert. Abstr.

**N76-14399** Georgia Inst. of Tech., Atlanta.
**ANALYSIS OF TWO-DIMENSIONAL TURBULENT WALL-JETS Ph.D. Thesis**
Jaunan Liaw 1975 162 p
Avail: Univ. Microfilms Order No. 75-26212

An analytic investigation of the flow field produced by two-dimensional, turbulent wall jets with and without a longitudinal free-stream pressure gradient is presented. Experimental data were analyzed to establish semiempirical relations for velocity profile similarities, shear stress similarities, wall sublayer similarities, and maximum shear stresses. An analytic function for the velocity profiles in the jet and wake layers was obtained

by least square fitting to experimental data. This analytic function was used in all subsequent data analysis to represent the experimental data with high accuracy. Similarity and semi-empirical results were utilized to develop an overall solution for turbulent boundary layer and wall jet flows. A step-by-step numerical solution of the partial differential equations was employed. Comparisons between the predicted and experimental data show agreement. Dissert. Abstr.

**N76-14400** Ohio State Univ., Columbus.
**THEORETICAL AND EXPERIMENTAL STUDIES OF MULTI-COMPONENT FLOW SYSTEMS Ph.D. Thesis**
Kenneth Duns Korkan 1975 230 p
Avail: Univ. Microfilms Order No. 75-26607

The particle conservation of momentum, energy, and continuity equations were derived for an uncoupled multicomponent flow system. The gaseous flow field consists of an inviscid two-dimensional flow in which both Prandtl-Meyer expansion waves and oblique shock waves can be embedded. A sphere drag coefficient correlation was formulated which fits the available experimental data within + or - 15% over a wide range of slip Mach numbers (0.1 to 7.0) and Reynolds numbers (4.9x10 deg to 7.7x10 4) and accounts for sphere wall temperatures different from that of the ambient temperature. The influence of the various sphere drag coefficient correlations on the predicted values of particle trajectory, velocity, and temperature was determined for three uncoupled multicomponent flow situations; uniform flow, Prandtl-Meyer expansion fan, and oblique shock for particle radii of 0.5 to 50 microns. The largest effect appears to be in the particle trajectory and particle velocity predictions for the Prandtl-Meyer expansion fan and uniform flow case with the particle temperature history being relatively unaffected.
Dissert. Abstr.

**N76-14401** Washington Univ., Seattle.
**THE APPLICATION OF ORTHOGONAL COLLOCATION TO LAMINAR FLOW HEAT AND MASS TRANSFER IN MONOLITH CONVERTERS Ph.D. Thesis**
Larry Clinton Young 1974 315 p
Avail: Univ. Microfilms Order No. 75-28475

A comprehensive theoretical study of the monolith converter is performed. This chemical reactor was used for the oxidation of carbon monoxide and hydrocarbons in automobile exhausts, and consists of an array of wall catalyzed cells or ducts through which the gas passes in laminar flow. A series of mathematical models for the device are proposed and solved. For the more complex models the problem is a full three dimensional transient one, and is complicated by the irregular geometry of the cells and a highly nonlinear reaction rate expression. A solution method was developed and applied, so that these complex model equations can be solved. The method utilizes the eigenvalues and other constants which result from the solution of laminar flow heat transfer problems. The orthogonal collocation method is reviewed and extended to problems with irregular boundaries. This method is used in the solution of the laminar flow heat transfer problems, and to model conduction and diffusion in the monolith wall.
Dissert. Abstr.

**N76-14402** Rochester Univ., N.Y.
**VISCOELASTIC FLOW BEHAVIOR IN ACCELERATING SHEAR FIELDS Ph.D. Thesis**
Eugene Bach Lieb 1975 323 p
Avail: Univ. Microfilms Order No. 75-22751

Two techniques for measuring dynamic viscoelastic behavior were investigated: the cone-and-plate and the concentric cylinder Couette rheometers, both with accelerating rotating members. It is analytically shown and experimentally confirmed that the error introduced by inertia resulting from angular acceleration in the cone-and-plate rheometer can be reduced to any desirable level by reduction of the cone angle for any finite acceleration. The optical cylindrical Couette rheometer is shown to be capable of enabling direct observation of velocity in dynamic shear fields with large inertial effects. The two devices complement each other in that the cone-and-plate system can be used to characterize the dynamic fluid properties, and the optical Couette device can be used to examine inertial effects. Simulations of accelerating Couette flow were conducted for the Newtonian, Prandtl-Eyring, Maxwell, Metzner-White, and Oldroyd models. Dissert. Abstr.

**N76-14403** Cincinnati Univ., Ohio.
**APPLICABILITY OF THE HOMOGENEOUS FLOW MODEL TO TWO-PHASE FLOW Ph.D. Thesis**
Ausaf Husain 1975 225 p
Avail: Univ. Microfilms Order No. 75-28927

An improved criterion for the onset of the homogeneous flow pattern in co-current vapor-liquid flow was developed. Based on the visual flow observations obtained during this study and those available in the literature. It is consistent with a general approach to the suspension of small bubbles and particles. One-dimensional momentum theory was used for the prediction of abrupt area change pressure losses in two-phase flow. Pressure change across expansions were well predicted if slip was assumed to occur at all the locations. Pressure drop across contractions were well correlated by assuming slip to occur at all locations except at the vena-contracta where the mixing action was postulated to cause a flow homogenizing effect. Pressure drop across expansion-contraction combinations was also in line with the separate contraction and expansion pressure changes. Two-phase frictional pressure drop in straight pipes and pressure changes across abrupt expansions and contractions were found to be in accord with the criterion of the onset of the homogeneous flow pattern. Dissert. Abstr.

**N76-14404** British Library Lending Div., Boston Spa (England).
**MEASUREMENT OF FLOW VELOCITIES AT HIGH TEMPERATURES UP TO 4500 K AND AT M UP TO 2**
Jiri Dundr [1975] 17 p refs Transl. into ENGLISH from Strojnicky Casopis (Prague), v. 16, no. 2 p 253-259 In ENGLISH and CZECHOSLOVAKIAN
(BLL-Dounreay-Tran-691(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Classical methods of measuring velocities are discussed; the characteristics of pneumatic methods are presented along with an analysis of their preciseness. An acoustic ultrasonic anemometer was proposed which is capable of measuring an arbitrarily oriented velocity vector in a given place in the flow. Author

**N76-14405#** National Aeronautical Establishment, Ottawa (Ontario). Flight Research Lab.
**VISCOUS FLOW INSTABILITY ON THE EDGE OF A SPINNING DISC**
A. M. Drummond Jul. 1975 57 p refs
(NRC-14856; LR-587; ISSN-0077-5541) Avail: NTIS HC $4.50

The flow of a thin film of viscous fluid on a spinning disc with a circular arc edge is considered. An approximate film thickness relation is derived which agrees well with experiment. A linearized free-surface instability theory was developed to predict the number of atomization sites at the disc edge. It is concluded that the experimentally determined mean number of atomization sites is within 10% of the theoretical prediction, and that 90% of the data will be within a calculable band about the theoretical line, provided the fluid viscosity is below about one stoke. The agreement between theory and experiment is unaffected by surface waves on the disc surface away from the edge or by the type of atomization at the disc edge (ligament or direct-drop). The effect of increasing either the fluid viscosity, surface tension, or film thickness is to reduce the number of atomization sites while increasing the angular velocity increases the number. Author

**N76-14406#** Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
**SUPERSONIC FLOW PAST CONICAL BODIES AT LARGE ANGLES OF ATTACK**
Shin-ichi Nakao Nov. 1975 53 p refs
(ISAS-534) Avail: NTIS HC $4.50

In order to solve the supersonic flow around a conical body with a large angle of attack by the inviscid equations (in such a flow the viscous effect of the separation region at the leeward side of the body is very important) the new concept of the equivalent body is introduced. The equivalent body consists of the original body at the windward side and an additional conical body at the leeward side which is expanded in proportion to the increase of the angle of attack. This additional conical body exhibits approximately the viscous effect of the separation region. What the lift off parameter of the vortical singularity kappa is equal to minus 8 at the leeward generator of the equivalent

body is used as the criterion which determines the dimensions of the equivalent body. By employing this concept, the supersonic flow around conical bodies can be calculated up to the angle of attack of twice as large as the semi-apex angle of the conical body. The results obtained by the present method are in good agreement with the experiments, and the usefulness of this method is indicated. Author

**N76-14407#** Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
**VISCOUS FLOW AROUND A TRANSVERSALLY OSCILLATING ELLIPTIC CYLINDER**
Atsushi Okajima (Kyushu Univ.), Hiroyuki Takata, and Tsuyoshi Asanuma Oct. 1975 31 p refs
(ISAS-533) Avail: NTIS HC $4.00

To furnish some fundamental information about viscous effects of flow on the aerodynamic characteristic of an elliptic cylinder, the Navier-Stokes equations are solved for flow around both stationary and transversally oscillating elliptic cylinders at Reynolds numbers of Re=40 and 80. Aerodynamic forces and pressure acting on an elliptic cylinder in the range of Reynolds numbers Re=40 to 20000 were measured. A good agreement was found between the calculated results and the experimental ones for steady and unsteady aerodynamic parameters at Reynolds numbers Re=40 and 80. On the basis of the numerical results, the time-variation of flow pattern around an elliptic cylinder (locations of stagnation points) was examined, and the effects of angle of attack, Reynolds number, and oscillatory frequency on aerodynamic parameters are discussed. Author

**N76-14408#** Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
**VISCOUS FLOW AROUND A ROTATIONALLY OSCILLATING CIRCULAR CYLINDER**
Atsushi Okajima (Kyushu Univ.), Hiroyuki Takata, and Tsuyoshi Asanuma Sep. 1975 29 p refs
(ISAS-532) Avail: NTIS HC $4.00

Aerodynamic characteristics of a circular cylinder either stationary or rotationally oscillating around its axis in uniform viscous flow were analyzed by numerical calculation and by experiment. The method and results of numerical solution of the Navier-Stokes equations by the finite difference analog are presented; measurements for the lift and the drag forces acting on the cylinder made by towing test models in still fluid in a range of Reynolds number, Re=40 to 6100 are included. Good agreement was obtained between the calculated results and the experimental ones at Reynolds numbers Re=40 and 80, concerning the steady and unsteady aerodynamic parameters and the phenomenon of the so-called synchronization. It becomes clear from numerical calculation that there may be a close relationship between the time-variation of the flow pattern and that of the lift force on an oscillating cylinder. The influence of Reynolds number on the aerodynamic parameters and the phenomenon of synchronization were examined. Author

**N76-14409#** Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
**A NUMERICAL METHOD FOR THE CALCULATION OF UNSTEADY TURBULENT FREE CONVECTION OVER A VERTICAL FLAT PLATE**
Jaroslav Remar (Elec. Supply Comm.) and Richard R. Horsley Jul. 1975 32 p refs
(ISBN-0-85494-321-8; Rept-60) Avail: NTIS HC $4.00

The unsteady turbulent free convection over a vertical flat plate is calculated. The growth of a turbulent boundary layer generated by buoyancy is mathematically formulated by a system of partial differential equations containing a phenomenological turbulence model. The system is solved numerically by finite differences, and fields of two velocity components, temperature and effective viscosity are obtained. It is also shown that the cooling rate goes through a minimum before reaching its steady state value. Author

**N76-14410#** Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
**MASS TRANSFER THROUGH A POROUS TUBE. PART 1: THEORY AND COMPUTER PROGRAMME**
B. A. Rotteveel Sep. 1975 119 p refs
(ISBN-0-85494-330-7-Pt-1; Rept-62-Pt-1) Avail: NTIS HC $5.50

The flow field which is examined is produced by a cylindrical pipe along which fluid passes axially. Through the porous walls of the pipe, fluid can be extracted or introduced in varying amounts. The situation is modelled using a potential flow technique involving the representation of the pipe surface by means of singularities such as sources and sinks. The strength of the method lies in its generality, as the solution does not require the boundary of the pipe to be analytic in shape, and the boundary conditions also need not be analytic or continuous. Regions of suction or mass addition may be applied to the pipe by an inclusion of suitable boundary conditions. Comparisons between theories and available experimental results are good. The potential flow solution provides a useful overall picture of the flow situation and predicts such properties as pressure distributions and suction variations. Author

**N76-14411*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**INCIDENT SHOCK-WAVE CHARACTERISTICS IN AIR, ARGON, CARBON DIOXIDE, AND HELIUM IN A SHOCK TUBE WITH UNHEATED HELIUM DRIVER**
Charles G. Miller, III and Jim J. Jones Washington Dec. 1975 84 p refs
(NASA-TN-D-8099; L-10520) Avail: NTIS HC $5.00 CSCL 20D

Incident shock-wave velocities were measured in the Langley 6-inch expansion tube, operated as a shock tube, with air, argon, carbon dioxide, and helium as test gases. Unheated helium was used as the driver gas and most data were obtained at pressures of approximately 34 and 54 MN/sq m. A range of pressure ratio across the diaphragm was obtained by varying the quiescent test-gas pressure, for a given driver pressure, from 0.0276 to 34.5 kN/sq m. Single- and double-diaphragm modes of operation were employed and diaphragms of various materials tested. Shock velocity was determined from microwave interferometer measurements, response of pressure transducers positioned along interferometer measurements, response of pressure transducers positioned along the driven section (time-of-arrival gages), and to a lesser extent, measured tube-wall pressure. Velocities obtained from these methods are compared and limitations of the methods discussed. The present results are compared with theory and the effects of diaphragm mode (single or double diaphragm), diaphragm material, heating of the driver gas upon pressurization of the driver section, diaphragm opening time, interface mixing, and two-dimensional (nonplanar) flow are discussed. Author

**N76-14412#** Southwest Research Inst., San Antonio, Tex.
**EXAMINATION OF HYDRAULIC CONDUITS WITH NONLINEAR TERMINAL RESISTANCE AND ENTRAINED GASES Final Report**
Jesse L. Holster and William J. Astleford 27 Jun. 1975 45 p refs
(IR Proj. 02-9120-001)
Avail: NTIS HC $4.00 CSCL 20D

A study was conducted to experimentally and analytically examine the effects of a nonlinear hydraulic resistance for a vertical transmission line terminated by an orifice and excited by a side branch flow pulsar. The added attenuation in the line created by uniformly distributed gas bubbles entrained in the liquid was also investigated. Results are discussed. Author

**N76-14413#** Catholic Univ. of America, Washington, D.C. Hydrodynamics Lab.
**THEORY OF WAKE COLLAPSE IN A STRATIFIED FLUID Technical Report, 1 May 1974 - 20 Jun. 1975**
Timothy W. Kao 20 Jun. 1975 20 p refs
(Contracts N00014-67-A-0377-0027; N00014-75-C-0910; NR Proj. 062-409; NR Proj. 062-449)
(AD-A014034; HY-75-002) Avail: NTIS CSCL 20/4

A complete theory of the collapse of a wake in the form of a two-dimensional circular mixed region of uniform density in a linearly stratified fluid is given. The initial stage is based on existing theories and the principal stage is based on the concept of a quasi-steady density current in a stratified environment. The two stages are properly matched. The dimensionless time at the initiation of the principal stage is theoretically determined.

The theoretical finding is in excellent agreement with previous numerical and experimental results. GRA

**N76-14414*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**AN EFFECTIVE SOLUTION TO THE NONLINEAR, NONSTATIONARY NAVIER-STOKES EQUATIONS FOR TWO DIMENSIONS**
Ralph E. Gabrielsen Aug. 1975 10 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Moffett Field, Calif.
(NASA-TM-X-62493; A-6294) Avail: NTIS HC $3.50 CSCL 20D

A sequence of approximate solutions for the nonlinear, nonstationary Navier-Stokes equations for a two-dimensional domain, from which explicit error estimates and rates of convergence are obtained, is described. This sequence of approximate solutions is based primarily on the Newton-Kantorovich method. Author

**N76-14415*#** Transemantics, Inc., Washington, D.C.
**PULSATIONS OF A SPHERICAL BUBBLE IN INCOMPRESSIBLE FLUID**
G. I. Bykovsev and G. S. Rozarenov Washington NASA Dec. 1975 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR. Mekh. Zhidk. Gaza, (USSR), Mar. - Apr. 1975 p 153-155
(Contract NASw-2792)
(NASA-TT-F-16836) Avail: NTIS HC $3.50 CSCL 20D

The behavior of a spherical cavity in an unbounded incompressible fluid is analyzed with allowance for the inertia of the ideal gas contained in the cavity. The motion of the gas is described by the equations of gas dynamics in spherical coordinates. The equations are integrated by the method of characteristics. It is shown that the inertia of the gas in the bubble has the effect of delaying collapse. Author

**N76-14416*#** Scientific Translation Service, Santa Barbara, Calif.
**THE PRINCIPLE OF THE SURFACE VISCOSITY OF LIQUIDS ESTABLISHED BY MR. J. PLATEAU**
Carlo Marangoni Washington NASA Jan. 1976 39 p refs Transl. into ENGLISH from Nuovo Cimento 2, Serie 2 (Italy), v. 5-6, 1872 p 239-273
(Contract NASw-2791)
(NASA-TT-F-16818) Avail: NTIS HC $4.00 CSCL 20D

Plateau's measurements are reviewed of surface viscosity of various liquids using the magnetic needle method. A modified device with a brass disc to repeat the measurements was used. Capillarity, surface layers of liquids, double nature of liquid surface tension, and surface elasticity are also discussed. Author

**N76-14417*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**A SIMPLIFIED ANALYTICAL SOLUTION FOR THERMAL RESPONSE OF A ONE-DIMENSIONAL, STEADY STATE TRANSPIRATION COOLING SYSTEM IN RADIATIVE AND CONVECTIVE ENVIRONMENT**
Hirotoshi Kubota Washington Jan. 1976 36 p refs
(NASA-TN-D-8129; A-6162) Avail: NTIS HC $4.00 CSCL 20M

A simplified analytical method for calculation of thermal response within a transpiration-cooled porous heat shield material in an intense radiative-convective heating environment is presented. The essential assumptions of the radiative and convective transfer processes in the heat shield matrix are the two-temperature approximation and the specified radiative-convective heatings of the front surface. Sample calculations for porous silica with CO2 injection are presented for some typical parameters of mass injection rate, porosity, and material thickness. The effect of these parameters on the cooling system is discussed. Author

**N76-14418*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**AN IMPROVED ACCUMULATOR Patent Application**
James R. Fenwick (Rocketdyne, Canoga Park, Calif.) and George H. Karigan, inventors (to NASA) (Rocketdyne, Canoga Park, Calif.) Filed 18 Dec. 1975 11 p. Sponsored by NASA
(NASA-Case-MFS-19287-1; US-Patent-Appl-SN-641832) Avail: NTIS HC $3.50 CSCL 20D

An improved accumulator particularly adapted for use in controlling the pressure of a stream of fluid in its liquid phase is disclosed; the accumulator utilizes the fluid in its gaseous phase. The accumulator is characterized by a shell defining a pressure chamber with an entry throat for a liquid and adapted to be connected in contiguous relation with a selected conduit with a stream of fluid flowing through the conduit in its liquid phase. A pressure and volume stabilization tube, including an array of pressure relief perforations is projected into the chamber with the perforations adjacent to the entry throat for accommodating a discharge of the fluid, in either gaseous or liquid phases, while a gas inlet and liquid to gas conversion system is provided for the chamber and connected with a source of the fluid for continuously pressurizing the chamber for controlling the pressure of the stream of liquid. NASA

**N76-14419*#** Agnew Tech-Tran, Inc., Woodland Hills, Calif.
**HYDRODYNAMICS IN WEAK FORCE FIELDS: ONSET OF THERMOCAPILLARY CONVECTION IN A SPHERICAL FLUID FILM UNDER CONDITIONS OF WEIGHTLESSNESS**
V. G. Babskiy and I. L. Sklovskaya Washington NASA Dec. 1975 14 p refs Transl. into ENGLISH from Izv., Akad. Nauk SSSR, Mekhan. Zhidkosti i Gaza (USSR), no. 3, May - Jun. 1969 p 92-99
(Contract NASw-2789)
(NASA-TT-F-16668) Avail: NTIS HC $3.50 CSCL 20D

Studies of cellular convection cite both Archimedian and thermocapillary forces as reasons for the onset of convection in unbounded plane layers of fluid having a free surface. When forces related to mass are absent or are negligibly small, it is natural to inquire about the onset of 'pure' thermocapillary convection or convection caused solely by surface tension gradients. This question was examined for a spherical layer of fluid under conditions of weightlessness. Author

**N76-14420#** Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
**AN EXPERIMENTAL STUDY OF A TURBULENT AXISYMMETRIC JET ISSUING INTO A COFLOWING AIRSTREAM**
S. Biringen Apr. 1975 77 p refs
(VKI-TN-110) Avail: NTIS HC $5.00

The development of an axisymmetric jet in a coflowing airstream was experimentally investigated. It was found that at some distance downstream of the nozzle the mean velocity field becomes similar, and depends only on the excess momentum of the jet if effective origin shifts are taken into account. The magnitudes of the Reynolds stresses increase with downstream distance but stay significantly lower than those found in axisymmetric wakes. The difference between longitudinal and lateral normal stresses implies a stronger degree of anisotropy as compared to free jets. The turbulent structure is found to depend on the initial velocity ratio between the outer stream and the jet over a considerable range. The inadequacy of the integral methods to predict all the features of this flow could be attributed partly to this. Author (ESA)

**N76-14421#** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**EFFECTS OF MASS TRANSFER INTO LAMINAR AND TURBULENT BOUNDARY LAYERS OVER CONES AT ANGLE OF ATTACK Final Report, 7 Dec. 1972 - 1 Apr. 1975**
Michael C. Frieders and Clark H. Lewis Aug. 1975 256 p refs
(Contract F40600-73-C-0005)
(AD-A013813; AEDC-TR-75-55) Avail: NTIS CSCL 20/4

A computer program has been developed for full three-dimensional boundary-layer analysis of sharp and blunt cones at angle of attack to supersonic and hypersonic flows. This analysis includes laminar, transitional, and turbulent flows, with mass transfer of various foreign gases at the wall. The governing boundary-layer equations are integrated on a digital computer using a marching implicit finite-difference scheme. Turbulence has been modeled by a two-layer eddy viscosity-mixing length approach employing an intermittency factor in the transition region. Results of the program calculations are compared to available experimental and numerical data. GRA

**N76-14422#** National Aeronautical Establishment, Ottawa (Ontario).
**A NUMERICAL DETERMINATION OF THE BOW SHOCK WAVE IN TRANSONIC AXISYMMETRIC FLOW ABOUT BLUNT BODIES**
D. J. Jones and J. C. South, Jr. May 1975 52 p
(AD-A014005; NAE-LR-586; NRC-14765) Avail: NTIS CSCL 20/4

A numerical method is developed for calculating axisymmetric transonic flow about a blunt body. The bow shock wave location is of particular interest. A Rankine Hugoniot jump is applied at the shock while relaxation on the isentropic equation of motion is used between shock and body. The shock wave is adjusted by a Newton type iteration scheme. Results are given for a sphere in the Mach number range 1.62 down to 1.02. GRA

**N76-14423#** Naval Ordnance Lab., White Oak, Md.
**HYPERSONIC TWO-PHASE FLOW WITH MASSIVE BLOWING Final Report, 19 Mar. 1974 - 19 Mar. 1975**
Kuei-Yuan Chien Wright-Patterson AFB, Ohio ARL Jun. 1975 26 p refs Sponsored by AF
(AF Proj. 7065)
(AD-A013686; ARL-75-0131) Avail: NTIS CSCL 20/4

The problem of a hypersonic two-phase flow over a porous flat plate (or banks of nozzles) with massive blowing was considered. The method of integral relations was applied to simplify the governing equations and the starting solution was discussed. A detailed review of the particle drag and heat-transfer laws was included. Some suggestions for further work were also discussed. GRA

**N76-14424#** Maryland Univ., College Park. Dept. of Aerospace Engineering.
**NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATIONS FOR LAMINAR AND TURBULENT SUPERSONIC MIXING FLOWS Final Report**
Everett Jones and John D. Anderson, Jr. Jun. 1975 145 p refs
(Grant AF-AFOSR-2575-74; AF Proj. 9750)
(AD-A013911; AE-75-5; AFOSR-75-1187TR) Avail: NTIS CSCL 20/4

A modification of MacCormack's two step computational method is applied to flow of a perfect gas with constant thermal properties between parallel, free boundaries. The complete Navier-Stokes equations were applied. Such flow predictions are fundamental to later extension of computer programs to include the kinetics and diffusion for flow downstream of the nozzle stacks with a chemical laser or a downstream mixing gasdynamic laser. A laminar flow program was constructed first and checked out by application to flow problems with exact solutions. The checkout of the laminar flow program indicated that satisfactory results could be obtained at reasonable expense. This program was extended to produce two turbulent flow programs. One program utilizes a mixing length model while the other applies the Saffman-Wilcox-Alber turbulence model. Application of the turbulent programs to nozzle exit flows with smooth profiles at the exit plane of the nozzles produced satisfactory results. However, if these profiles have the discontinuous profiles characteristic of the ideal mixing of two parallel streams, a relatively small amplitude, steady state oscillation develops. Further investigations are in process to remove this oscillation and to extend these programs to treat downstream mixing gasdynamic lasers. GRA

**N76-14425#** Catholic Univ. of America, Washington, D.C.
**ON VORTEX STRUCTURE IN THE WAKE OF A SPHERE**
Hsien-Ping Pao and Timothy W. Kao 1 May 1975 26 p refs
(Contract N00014-67-A-0377-0027; NR Proj. 062-498)
(AD-A014061; HY-75-100) Avail: NTIS CSCL 20/4

This paper presents results showing the three-dimensional vortex shedding structure when a sphere is towed at a constant velocity through a stratified fluid. It is found that for certain Richardon and Reynolds numbers the vortex is shed three-dimensionally. The stratification however quickly inhibits the vertical motion and the initially turbulent wake collapses and reveals the vertically oriented portion of the vortex structure, reminiscent of two-dimensional vortex street behind a circular cylinder when viewed from above. Two branches of a double helix are continuously unwinding in an opposite sense from the formation region. The double helical model satisfies Thompson's circulation theorem. GRA

**N76-14426#** Drexel Univ., Philadelphia, Pa.
**MCDU-8-A COMPUTER CODE FOR ONE-DIMENSIONAL BLAST WAVE PROBLEMS**
Donald L. Tuckmantel, James Mao, and Pei Chi Chou Jul. 1975 111 p refs
(Contract DAAD05-70-C-0175)
(AD-A013864; BRL-CR-243; Rept-72-8) Avail: NTIS CSCL 19/4

The method of characteristics computer code MCDU-8 which calculates solutions for one-dimensional blast wave problems is described. Since the code does not treat the detonation wave, it commences calculation when the detonation emerges from the charge surface. Subsequently, shocks are traced exactly using the Rankine-Hugoniot relations while continuous regions are calculated using the method of characteristics. Comparisons are presented between MCDU-8 solutions for spherical pentolite and other solutions and experiments. Author (GRA)

**N76-14427#** Air Force Weapons Lab., Kirtland AFB, N.Mex.
**INVESTIGATION OF SOLIDIFICATION OF NITROUS OXIDE UNDER FLOW CONDITIONS Final Report, 30 Jun. - 30 Aug. 1974**
Melvin Eisenstadt and James Cawthra Jul. 1975 22 p
(AF Proj. 317J)
(AD-A013772; AFWL-TR-74-265) Avail: NTIS CSCL 14/2

Under emergency conditions, it may be necessary to land the Airborne Laser Laboratory (ALL) aircraft with the propellant tanks empty. For this reason, the design provides for dumping liquid propellants and venting gaseous propellants to the atmosphere. Indications were that dumping and venting the N2O tank might be problematic. Two actual incidents generated concern regarding possible solidification of the N2O in the dump and/or vent lines if the tank were emptied during flight. It was felt that if solidification took place in the lines, the lines might be blocked and the N2O tank could not be emptied. The report describes both the theoretical and experimental work done in order to evaluate the problem. The theoretical analysis aided greatly in understanding what was happening and why, but it was incapable of assessing whether or not an operational problem existed during dumping of the N2O. This question was finally settled by a test program, and it was found that dumping and venting N2O presented no operational problems. GRA

# 35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

**N76-14428** Ohio State Univ., Columbus.
**SCATTERING THEORY OF HOLOGRAPHIC DIFFRACTION Ph.D. Thesis**
Tommy Lee Williamson 1975 168 p
Avail: Univ. Microfilms Order No. 75-26688

A theoretical and experimental analysis is presented of the diffraction process in bleached silver halide emulsions. The analysis is based on the particle nature of the emulsion, and is sufficiently general to permit the determination of the angular response of the hologram and its diffraction efficiency from the measured parameters of the emulsion. The analysis of the holographic process consists of an analysis of the recording of the interference pattern resulting from the superposition of two coherent fields on a photographic emulsion and the subsequent processing of the emulsion, and a description of the interaction of the incident reconstructing field with the volume of scatterers within the holographic emulsion. The experimental analysis determines the material properties of the emulsion and provides a quantitative

determination of the probability that a scatterer will exist at a given site in the hologram. Dissert. Abstr.

**N76-14429*** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**STATIC PRESSURE PROBE Patent**
Shimer Z. Pinckney, inventor (to NASA) Issued 28 Oct. 1975 5 p Filed 29 Oct. 1974 Supersedes N75-10412 (12 - 01, p 0055)
(NASA-Case-LAR-11552-1; US-Patent-3,914,997; US-Patent-Appl-SN-518685; US-Patent-Class-73-182; US-Patent-Class-73-212) Avail: US Patent Office CSCL 14B

An improved static pressure probe is described which has a smaller length than conventional static probes with the same diameter, and it requires no compensation for yaw angles of up to 10. Official Gazette of the U.S. Patent Office

**N76-14430*** National Aeronautics and Space Administration. Pasadena Office, Calif.
**STRAIN GAGE MOUNTING ASSEMBLY Patent**
Robert H. Silver (JPL) and Sarkis H. Kalfayan, inventors (to NASA) (JPL) Issued 28 Oct. 1975 6 p Filed 24 Jul. 1973 Supersedes N73-28495 (11 - 19, p 2300) Sponsored by NASA
(NASA-Case-NPO-13170-1; US-Patent-3,914,991; US-Patent-Appl-SN-382261; US-Patent-Class-73-88.5R; US-Patent-Class-338-6) Avail: US Patent Office CSCL 14B

A strain gage assembly mounted on a container to monitor its internal pressure is described. A strain gage device is mounted in compression between a pair of mounting collars. The mounting arrangement translates the total strain displacement of the object or container under test between the mounting collars to apply it across the smaller gage length distance thus attaining a mechanical multiplication or amplification.
Official Gazette of the U.S. Patent Office

**N76-14431*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SHOCK POSITION SENSOR FOR SUPERSONIC INLETS Patent**
Miles O. Dustin inventor (to NASA) 7 Oct. 1975 7 p Filed 30 May 1974 Supersedes N74-25805 (12-15, p 1774)
(NASA-Case-LEW-11915-1; US-Patent-3,911,260; US-Patent-Appl-SN-474744; US-Patent-Class-235-151.34; US-Patent-Class-60-39.29; US-Patent-Class-137-15.2) CSCL 14B

Static pressure taps or ports are provided in the throat of a supersonic inlet, and signals indicative of the pressure at each of the ports is fed to respective comparators. Means are also provided for directing a signal indicative of the total throat pressure to the comparators. A periodic signal is superimposed on the total throat pressure so that the signal from the static pressure tabs is compared to a varying scan signal rather than to total throat pressure only. This type of comparison causes each comparator to provide a pulse width modulated output which may vary from 0% 'time on' to 100% 'time on'. The pulse width modulated outputs of the comparators are summed, filtered, and directed to a controller which operates a bypass valve such as a door whereby air is dumped from the inlet to prevent the shock wave from being expelled out the front.
Official Gazette of the U.S. Patent Office

**N76-14432*#** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
**A COLLECTION OF ARTICLES ON S/X-BAND EXPERIMENT ZERO DELAY RANGING TESTS, VOLUME 1**
T. Y. Otoshi, ed. 1 Nov. 1975 130 p refs
(Contract NAS7-100)
(NASA-CR-145918; JPL-TM-33-747-Vol-1) Avail: NTIS HC $6.00 CSCL 14B

Articles are presented which are concerned with the development of special test equipment and a dual-frequency zero delay device (ZDD) that were required for range tests and the measurement of ground station delays for the Mariner-Venus-Mercury 1973 S/X-band experiment. Test data obtained at DSS 14 after installation of the ZDD on the 64-m antenna are given. It is shown that large variations of range were observed as a function of antenna elevation angle and were sensitive to antenna location. A ranging calibration configuration that was subsequently developed and a technique for determining the appropriate Z-correction are described. Zero delay test data at DSS 14 during the Mariner 10 Venus-Mercury-Encounter periods (1974 days 12-150) are presented. The theoretical analysis and experimental verifications are included of the effects of multipath and effects of discontinuities on range delay measurements. A movable subreflector technique and the multipath theory were used to isolate principal multipath errors on the 64-m antenna and to enable a more accurate determination of the actual ground station range delay. Author

**N76-14433*#** National Aeronautics and Space Administration. Pasadena Office, Calif.
**INTERFEROMETER MIRROR TILT CORRECTING SYSTEM Patent Application**
Rudolf A. Schindler, inventor (to NASA) (JPL) Filed 18 Dec. 1975 16 p
(Contract NAS7-100)
(NASA-Case-NPO-13687-1; JPL-Case-13687; US-Patent-Appl-SN-641803) Avail: NTIS HC $3.50 CSCL 14B

An interferometer is described which has servo means for automatically adjusting the angular tilt of a reflecting surface in one of two paths to maintain the exit beams from the two paths parallel to each other. Three detectors at the output of the interferometer are disposed on mutually perpendicular axes which define a plane normal to the nominal exit beam axis. One detector at the origin of the axes is used as a reference for separate phase-difference comparison with the outputs of the other two detectors on the X and Y axes to develop servo error signals. NASA

**N76-14434*#** National Aeronautics and Space Administration. Pasadena Office, Calif.
**FORWARD-SCATTER POLARIMETER FOR DETERMINING THE GASEOUS DEPOLARIZATION FACTOR IN THE PRESENCE OF POLLUTING POLYDISPERSED PARTICLES Patent Application**
Alain L. Fymat, inventor (to NASA) (JPL) Filed 18 Dec. 1975 18 p
(Contract NAS7-100)
(NASA-Case-NPO-13756-1; JPL-Case-13756; US-Patent-Appl-SN-641801) Avail: NTIS HC $3.50 CSCL 14B

A method and an apparatus are described for determining, under conditions of near-forward scattering, the depolarization factor of gases in an arbitrary mixture with polydispersions of unknown polluting particles of any size distribution and concentration. NASA

**N76-14435#** National Aviation Facilities Experimental Center, Atlantic City, N.J.
**INSTRUMENTATION FOR PROPELLER BLADE VIBRATION FLIGHT AND GROUND TESTING Final Report, Sep. 1969 - Jul. 1974**
Anthony J. Barile Aug. 1975 79 p refs
(FAA Proj. 184-520-010)
(AD-A015244/7; FAA-NA-74-42; FAA-RD-75-83) Avail: NTIS HC $4.75 CSCL 01/3

The stress measurement process is considered with a detailed description of the various options available to transmit signals from the propeller to the airframe. The procedures with which the transmitted signals may be recorded, processed, and reduced to meaningful information are presented with an assessment of their relative merits. An in-depth description of strain gage installation techniques is presented, depicting short- as well as long-term all-weather installations. Further discussion is addressed to electronic data processing and a typical flight test profile.
Author

**N76-14436*#** Alabama Univ., Huntsville. Center for Environmental and Energy Studies.
**INTEGRATED REAL TIME CONTAMINATION MONITOR (IRTCM) Quarterly Progress Report, 11 Sep. - 10 Dec. 1975**
W. E. Luttges 10 Dec. 1975 27 p
(Contract NAS8-31174)
(NASA-CR-144107) Avail: NTIS HC $4.00 CSCL 14B

Preparations for a sampling of the ozone layer on a balloon flight and design modifications to the flight sampling system are reported. Special attention was given to technical problems with the evacuated sampling flask valve and its performance at a vacuum of 10 to the 7th power Torr. Author

**N76-14437#** National Physical Lab., Teddington (England). Div. of Chemical Standards.

**SUMMARY OF WORK PERFORMED ON NPL AEI EM7 1 MV ELECTRON MICROSCOPE, 1970 - 1974**

K. F. Hale Jul. 1975 22 p refs

(NPL-Chem-37) Avail: NTIS HC $3.50

Work performed on the 1 MV electron microscope is surveyed. The applications cover microstructural investigations (glasses and ceramics), eutectics, general metallurgy, and environmental cell work. ESA

**N76-14438#** National Bureau of Standards, Washington, D.C. Vibration Section.

**PIEZOELECTRIC ACCELEROMETER LOW-FREQUENCY RESPONSE BY SIGNAL INSERTION METHODS Final Report**

Robert S. Koyanagi and James D. Pollard May 1975 34 p refs

(Contract CCG-74-93)

(COM-75-11069/2; NBSIR-74-597) Avail: NTIS HC $4.00 CSCL 14B

The frequency response of selected piezoelectric accelerometers was compared. Using a signal insertion method to the response using traditional mechanical vibration tests. Signal insertion methods included 'voltage insertion' and charge insertion techniques. The signal is inserted in series with the electrical low-side of the accelerometer by means of a suitable series resistance. Commercially available insertion devices were used. Confidence in the use of insertion methods is increased where there is agreement between the results from insertion tests and mechanically excited tests. GRA

**N76-14439#** Montana State Univ., Bozeman. Water Resources Research Center.

**DIGITAL INSTRUMENTATION AND TELEMETRY FOR WATER RESOURCES RESEARCH Completion Report**

Donald K. Weaver Dec. 1974 11 p refs

(OWRT Proj. B-014-MO(1))

(PB-243511/3; W75-09529) Avail: NTIS HC $3.50 CSCL 09F

The development of digital instrumentation and telemetry for water resources research is reported. Considerable study was made as to the specifications for the remote instrument package. A digital clock and multiplexor have been developed that output the standard time record each time a control signal is applied to the multiplexor control input. Several transmitter and receiver units have been incorporated in remote data acquisition systems operated by other agencies. GRA

**N76-14440#** Missouri Univ., St. Louis. Dept. of Physics.

**PORTABLE DEVICE FOR THE QUANTITATIVE DETERMINATION OF TRACE ELEMENTS IN WATER IN THE SUB-NANOGRAM SENSITIVITY RANGE Completion Report**

Charles C. Foster and Robert Hight 18 Apr. 1975 111 p refs

(Contracts DI-14-31-0001-3825; DI-14-31-0001-4025; OWRT Proj. A-064-MO(2))

(PB-243132/8; W75-09126) Avail: NTIS HC $5.50 CSCL 07D

Alpha particles and protons from charged particle accelerators and photons from both X-ray tubes and radioactive sources have been shown to be useful for the excitation of characteristic X-rays for multi-element energy dispersive trace analysis of environmental samples to the few ppm range. The use of 4.5 MeV alpha particles from a thin window Po-210 source of 5 mCi effective strength to directly excite X-rays from trace elements in 1 cc water samples is reported. Minimum detectable amounts were established for 20 elements using K-, L- and M- radiation and 50 minute counting times. GRA

**N76-14441#** Naval Postgraduate School, Monterey, Calif.

**AN EXPENDABLE MEASURING DEVICE FOR LIGHT ATTENUATION IN THE OCEAN M.S. Thesis**

Glen Dean Snyder Jun. 1975 60 p refs

(AD-A013607) Avail: NTIS CSCL 14/2

The feasibility of an inexpensive expendable device for determining the diffuse attenuation coefficient k for downwelling irradiance in ocean waters is investigated. A suggested instrument for such measurements in a modified standard U.S. Navy Expendable Bathythermograph (XBT) probe used in conjunction with an unmodified launcher and recorder. Information gained from such a device would rapidly supplement existing inadequate data and could be utilized by tacticians in determining the capabilities of underwater optical systems to a higher degree of certainty than presently possible. In addition such a probe could be used by fisheries biologists to calculate euphotic depths and to improve standing phytoplankton crop estimates. Author (GRA)

**N76-14442#** General Dynamics/Convair, San Diego, Calif. Aerospace Div.

**STUDY OF SIX-COMPONENT INTERNAL STRAIN GAGE BALANCES FOR USE IN THE HIRT FACILITY Final Report, Apr. 1973 - Feb. 1974**

M. L. Kuszewski, P. J. Mole, and S. A. Griffin Jul. 1975 41 p refs

(Contract F40600-72-C-0015)

(AD-A013815; CASD-AFS-73-009; AEDC-TR-75-63) Avail: NTIS CSCL 14/2

The need for a High Reynolds Number Transonic Wind Tunnel (HIRT) has been recognized throughout the industry for some years. The proposed HIRT facility at Arnold Engineering Development Center will provide a much needed tool for the study of phenomena sensitive to Reynolds number. The usefulness of the HIRT facility will be largely influenced by the ability of industry to design and build wind-tunnel models and internal strain gage balances capable of operating within the severe environment of the tunnel. The balance concept selected for this study has been used for the past ten years at General Dynamics and is known as a two-shell balance. Information presented is based on experience together with the results of experimental work in progress at General Dynamics. GRA

**N76-14443#** Army Engineer Topographic Labs., Fort Belvoir, Va.

**HOLOGRAPHIC COMPENSATION OF WAVEFRONT ABERRATIONS IN OPTICAL SYSTEMS Research Note, Jul. 1973 - Jun. 1974**

William R. Graver Jun. 1975 58 p refs

(DA Proj. 4A1-61101-A-91D)

(AD-A013978; ETL-RN-74-11) Avail: NTIS CSCL 14/5

Holographic compensation of residual aberrations in an experimental optical system is investigated. A series of holographic corrector plates (HCP's) of a given subject lens are constructed for on-axis, monochromatic point sources only. A Hartmann mask is constructed and used to determine the relative effectiveness of the HCP to compensate for point sources that are positioned up to plus or minus 5 degrees off-axis. Although off-axis corrections by the lens/HCP system are more than adequate when compared with the lens alone, hologram diffraction efficiency and vignetting of the diffracted light at the entrance pupil of the lens greatly reduce the HCP effectiveness. To overcome these problems, phase-type holograms having a 40.0 percent diffraction efficiency and secondary HCP's placed directly against the subject lens are constructed. In addition, an HCP repositioning technique based on Moire fringe patterns is developed. GRA

**N76-14303*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Elements Research Section.

**AN X-BAND RADIOMETER FOR THE MICROWAVE WEATHER PROJECT**

M. S. Reid, O. B. Parham, and R. A. Gardner *In its* The Deep Space Network 15 Oct. 1975 p 54-59 refs (For availability see N76-14296 05-31)

CSCL 14B

# 36 LASERS AND MASERS

Includes parametric amplifiers.

**N76-14444** Michigan State Univ., East Lansing.
**A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE MECHANISMS OF THE HYDROGEN-FLUORIDE PULSED CHEMICAL LASER Ph.D. Thesis**
Joseph J. T. Hough 1975 135 p
Avail: Univ. Microfilms Order No. 75-27274

Kinetic mechanisms in the pulsed HF chemical laser were examined by comparing predictions from improved theoretical models with experimental observations. Additional insight into these mechanisms was obtained by examining the predictions of the models in regions outside the domain of the present experiments. Two rate-equation models are developed for the F + H2 and F2 + H2 lasers. Both models simulate cavity transients such as the interaction of the chemical kinetic and radiative phenomena within the active medium in the pulsed HF chemical laser. Calculations slow that the growth in intensity is sufficiently slow that the gain may attain levels far above threshold before lasing begins. Intensity increases sharply after the gain is far above threshold, which causes the gain to drop rapidly and oscillate near the threshold value. This fluctuation in gain, which is a result of fluctuation in HF(v,j) populations, makes the calculations more sensitive to relaxation processes than was shown by earlier constant-gain models. Dissert. Abstr.

**N76-14445** Cornell Univ., Ithaca, N.Y.
**ELECTRO-OPTICAL TUNING OF THE CW DYE LASER AND ATTENDANT EXPERIMENTS IN SPECTROSCOPY Ph.D. Thesis**
John Martin Telle 1975 106 p
Avail: Univ. Microfilms Order No. 75-27867

A method is discussed which provides broad band (hundreds of A) electronic tuning of the CW dye laser; data are given to verify the method. The method is electro-optical in nature. Various crystal orientations and their corresponding tuning rates (in A per kilovolt) are given. Basic filter characteristics (bandwidth, free spectral range) and resultant laser emission characteristics are also discussed. An experimental and theoretical study of the laser output as a function of time when rapidly tuned is given. It was found that the total laser power undergoes a number of oscillations about some equilibrium value during the period of rapid tuning. A rate equation analysis is undertaken which culminates in a computer simulation of the laser action. The computer simulation demonstrates close agreement between experiment and theory. Dissert. Abstr.

**N76-14446** New Mexico State Univ., University Park.
**PASSIVE Q-SWITCHING AND MODE-LOCKING OF A CO2 LASER THE HALOGENATED BENZENE DERIVATIVES AS SATURABLE ABSORBERS Ph.D. Thesis**
George Fredrick Caudle 1975 167 p
Avail: Univ. Microfilms Order No. 75-28921

Benzene and 11 of its halogenated derivatives were studied as possible Q-switching agents for the low pressure CO2 laser. They represent a class of compounds which have one or more strong absorption bands in the 9 to 11 microns spectral region which tend to persist from one member of the class to another because of the structural similarity of the molecules. The molecules studied were: benzene, chlorobenzene, bromobenzene, o-dichlorobenzene, m-dichlorobenzene, m-difluorobenzene, m-fluorophenol, pentafluorobenzene, hexafluorobenzene, o-chlorotoluene, bromopentafluorobenzene and pentafluorotoluene. The first 9 of these mode-locked and Q-switched the laser for 123 laser line-saturable absorber combinations. The last three compounds did not Q-switch the laser on any line. The CO2 laser used was a flowing-gas, large bore, low pressure laser with an active cavity 1.8 m long. Dissert. Abstr.

**N76-14447*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
**COMBINED DUAL SCATTER, LOCAL OSCILLATOR LASER DOPPLER VELOCIMETER Patent**
Kenneth L. Orloff, inventor (to NASA) Issued 28 Oct. 1975 7 p Filed 27 Feb. 1974 Supersedes N74-18099 (12 - 09, p 1050)
(NASA-Case-ARC-10642-1; US-Patent-3,915,572; US-Patent-Appl-SN-446562; US-Patent-Class-356-106R; US-Patent-Class-356-28) Avail: US Patent Office CSCL 20E

A laser Doppler velocimeter is described which is capable of effectively measuring two different velocity components of a fluid simultaneously. Such a velocimeter includes a pair of coherent beams of laser light which are focused to an intersection point through which flow particles within the fluid whose velocity is to be measured. Both beams are plane polarized with the plane of polarization of one being rotated normally with respect to the other, which the result that the scattered radiation is separable into two different beams respectively corresponding to the two incident beams. Such scattered radiation is Doppler shifted by the moving particles and is collected for conventionally providing a measurement of the velocity of any particle flowing through the intersection point on a path which is generally transverse. The wavelength of the light scattered by the particles from one of the beams is compared to the wavelength of such beam prior to it being Doppler shifted by the moving particles.
Official Gazette of the U.S. Patent Office

**N76-14448*#** Illinois Univ., Urbana. Radio Research Lab.
**THE EFFECTS OF RANDOM PATH FLUCTUATIONS ON THE ACCURACY OF LASER RANGING SYSTEMS**
C. S. Gardner and N. Narayana Rao Dec. 1975 56 p refs (Grant NsG-5049)
(NASA-CR-145965; UILU-ENG-75-2552; RRL-Publ-469) Avail: NTIS HC $4.50 CSCL 20E

The precision of satellite ranging systems, limited in part by atmospheric refraction and scattering, is examined. The effects of atmospheric turbulence on the accuracy of single color and multicolor ranging systems is discussed. The statistical characteristics of the random path length fluctuations induced by turbulence are examined. Correlation and structure functions are derived using several proposed models for the variations of the optical path length. For single color systems it is shown that the random path length fluctuations can limit the accuracy of a range measurement to a few centimeters. Two color systems can partially correct for the random path fluctuations so that in most cases their accuracy is limited to a few millimeters. However, at low elevation angles and over long horizontal paths two color systems can also have errors approaching a few centimeters. Author

**N76-14449#** Defence Research Establishment Valcartier (Quebec).
**PRELIMINARY RESULTS OBTAINED USING A RANGE-GATED PULSED TEA-CO2 LADAR IMAGING SYSTEM**
J. F. Boulter Oct. 1975 28 p refs
(CRDV-4043/75) Avail: NTIS HC $4.00

A rangegated ladar imaging system based on a pulsed TEA-CO2 laser is described and low resolution (24-by-32 element) ladar images of targets at ranges between 45 m and 1.74 km are obtained. Comparison with visible light photographs, digitized using the same spatial resolution, was made and degradation of the ladar images due to target specularity and amplitude scintillation was discussed. Techniques for processing and analyzing the ladar images are described. Author

**N76-14450#** Australian Post Office Research Labs., Melbourne.
**LASER MODE-LOCKING TECHNIQUES FOR COMMUNICATIONS APPLICATIONS**
H. Sabine Nov. 1974 42 p refs
(Rept-6903) Avail: NTIS HC $4.00

A survey is presented of available techniques for locking the phases of oscillating laser modes so that the laser output becomes a regenerative optical pulse train. The suitability of these various techniques for applications in optical communications systems is assessed. A recommendation as to the most effective mode-locking method for this application is made.
Author

**N76-14451#** Naval Research Lab., Washington, D.C.
**ARPA-NRL LASER PROGRAM Semiannual Technical Report to DARPA, 1 Jan. - 30 Jun. 1974**
J. R. Airey, L. Champagne, N. Djeu, J. K. Hancock, and Neville Harris Apr. 1975 263 p refs
(DARPA Order 2062; NRL Proj. NO1-48; NRL Proj. K03-53)

(AD-A013215; NRL-MR-3005) Avail: NTIS CSCL 20/5

The ARPA-NRL Laser Program is concerned with the development of laser technology in three project areas: Chemical Infrared Lasers, Electrical Infrared Lasers and Electronic State Lasers. The Chemical Infrared Laser Program is focussed on DF-CO2 supersonic transfer laser experiments designed to evaluate chemical augmentation of gas dynamic lasers. Augmentation has been observed but is limited by deactivation processes. The temperature dependence of energy transfer processes in CO, CO2, and N2O has been measured. The Electrical Infrared Laser Program has two primary projects, short-pulse CO2 laser technology and electric-discharge gas dynamic lasers (EDGDL). The short pulse laser project has successfully been completed culminating in reliable 70 J single-pulse operation. A compact high-pressure e-beam-controlled CO2 laser has been developed for the generation of picosecond laser pulses. Infrared fluorescence from HCl generated by energy transfer from vibrationally excited D2 has been measured. GRA

**N76-14452#** Naval Research Lab., Washington, D.C.
**TOWARD SHORTER WAVELENGTH LASERS AND BREAKING THE 1000-ANGSTROM BARRIER. PART 4: CHARGE EXCHANGE AND ELECTRON CAPTURE Interim Report**
A. W. Ali May 1975 23 p refs
(NRL Proj. N01-33)
(AD-A013213; NRL-MR-3060-Pt-4) Avail: NTIS CSCL 20/5

The near resonance charge exchange as a pumping mechanism for short wavelength lasers is discussed. Several reactions are suggested for lasers below 1000 A. Author (GRA)

**N76-14453#** United Technologies Research Center, East Hartford, Conn.
**INFLUENCE OF BEAM JITTER ON THERMAL BLOOMING Semiannual Technical Report, 6 Jan. - 30 Jun. 1975**
Frederick G. Gebhardt 1 Aug. 1975 45 p refs
(Contract N00014-75-C-0649; ARPA Order 2439)
(AD-A014043; R75-922050-6) Avail: NTIS CSCL 20/6

Laboratory simulation experiments have been carried out to investigate the effects of beam jitter on the thermal blooming of a laser beam propagating in an absorbing medium with a transverse wind. Results obtained with a broadband, low pass white noise jitter frequency spectrum are in good agreement with the root-sum-square approach which considers the jitter and blooming effects to be independent. The effects of beam jitter on the scaling laws for thermal blooming are considered. GRA

**N76-14454#** Systems Science and Software, La Jolla, Calif.
**SENSITIVITY ANALYSIS OF A CHEMICAL LASER SYSTEM Final Report, 21 Mar. - 30 Jun. 1975**
H. B. Levine Aug. 1975 70 p refs
(Contract N00014-75-C-0981; ARPA Order 1806)
(AD-A013613; SSS-R-75-2684) Avail: NTIS CSCL 20/5

A new technique of sensitivity analysis has been applied to the Kerber-Emanuel-Whittier model of a pulse mode hydrogen fluoride chemical laser, so as to determine which parameter uncertainties most critically influence the model's ability to predict laser performance. The particular parameters directly considered were thirteen rate constants out of a set of 68 rate constants in the model, and also the initial concentration of fluorine atoms that start the chain processes which lead to population inversion. In an indirect sense, all 68 rate constants have been studied, because of empirical relations between various sets of constants controlling the formation rates of the excited vibrational states of the hydrogen fluoride molecule. The study covers the time period from 0.1 to 4.0 microseconds following initiation, and presently considers only zero power operation. Future work will treat the finite power case. The study demonstrates how the parameter uncertainties influence the predictions of the model. It shows that only a small subset, four in number, of all the parameters, have uncertainties which cause significant variance in the predictions. That is to say, the performance of the system, in the time range studied, is almost totally independent of the uncertainties in most of the rate constants. GRA

**N76-14455#** Maryland Univ., College Park. Dept. of Physics and Astronomy.
**DOUBLE SCATTERING CORRECTION IN THE INTERPRETATION OF RAYLEIGH SCATTERING DATA NEAR THE CRITICAL POINT OF A BINARY LIQUID**
Alan J. Bray and Ren-Fang Chang May 1975 45 p refs
(Contract N00014-67-A-0239-0014)
(AD-A013590; TR-75-086) Avail: NTIS CSCL 20/6

Double scattering contributions to the intensity of Rayleigh-scattered light near the critical point of a binary liquid are calculated for 90 deg scattering. A family of sample geometrics is considered, namely cylinders with arbitrary length to radius ratio and cuboids with square cross-sections and arbitrary length to side ratio. For binary liquids with nearly matched refractive indices, these terms can be sufficiently large that they affect the interpretation of data with respect to the value of the critical exponent eta and the deviation of the correlation function from Ornstein-Zernike form, yet small enough that higher order contributions can be neglected. Numerical results are presented for all temperatures above T sub c together with analytical results in certain limiting cases. Near the critical point, the double scattered intensity is comparable with that lost through extinction and these two effects cancel in leading order. Some analytical results are also obtained for the depolarization ratio. GRA

**N76-14456#** Isomet Corp., Springfield, Va.
**GROWTH OF DOPED AND UNDOPED SINGLE CRYSTAL LASER MATERIALS IN THE SYSTEM (MF2) subx X (YF3)sub1 MINUS x Final Report, Mar. 1973 - Apr. 1974**
Joseph F. Balascio Wright-Patterson, AFB, Ohio AFML 23 May 1975 35 p refs
(Contract F33615-73-C-5058; AF Proj. 7371)
(AD-A013878; TR-225; AFML-TR-75-66) Avail: NTIS CSCL 20/2

Laser host materials were grown in the CaF2-YF3 and BaF2-YF3 binaries. Two compositions in the former binary were found to be capable of producing single crystals: 9CaF2.YF3 and CaF2.2.6YF3. The former possessed a fluorite structure and the latter was indexed on a hexagonal unit cell. Trivalent and divalent rare earth-doped single crystals of these compositions were successfully grown. The necessary phase equilibria is presented and discussed. GRA

**N76-14457#** Aerospace Corp., El Segundo, Calif.
**DENSITY PERTURBATIONS INDUCED BY A SLUING LASER BEAM Interim Report**
John W. Ellinwood, Harold Mirels, and Robert L. Varwig 15 Jul. 1975 98 p refs Sponsored in part by Navy
(Contract F04701-75-C-0076)
(AD-A013739; TR-0076(6725)-1; SAMSO-TR-75-189) Avail: NTIS CSCL 20/6

A theoretical and experimental investigation of the density perturbations induced by absorption in a sluing laser beam has been conducted with emphasis on transonic crossflows. A linearized theory for the time-dependent density perturbations induced after turning on an arbitrary heat distribution within an arbitrary crossflow has been developed and programmed for routine computations. A closed-form solution has been obtained for the special case of sonic crossflow (M = 1) and a uniform heat distribution. The limits of validity of the linearized theory are obtained for M near one and large time. It is concluded that, in general, the transonic region does not significantly affect laser beam propagation. An experiment was conducted to compare the density perturbations predicted by linearized theory with experimental observations. A CW HF laser beam was rotated across an absorption cell located within a Mach-Zehnder interferometer. Fringe shifts were observed, as predicted by linearized theory, when the crossflow (sluing rate) was subsonic. No fringe shifts were observed at transonic speeds partly because of the onset of nonlinear effects. GRA

**N76-14458#** Air Force Weapons Lab., Kirtland AFB, N.Mex.
**ANALYSIS OF A HELIUM PRESSURANT LOADING SYSTEM FOR A FLUID SUPPLY SYSTEM (FSS) Final Report, 1 Jan. - 31 Jul. 1974**
Dean A. Schneider Jun. 1975 20 p
(AF Proj. 317J)
(AD-A013774; AFWL-TR-74-270) Avail: NTIS CSCL 14/2

A gas dynamic laser is a combustor-driven device that requires propellants for operation. The propellants are supplied to the combustor by the fluid supply system (FSS)5 This report describes

a model for the analysis of a fluid supply system loading system to determine the pressure-, temperature-, and mass-time history of the helium pressurant during loading. The equations developed were coded into a computer program. Sample results are given. GRA

# 37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

**N76-14459** Ohio State Univ., Columbus.
**A MODULAR UPPER BOUND METHOD FOR THE ANALYSIS OF METAL FORMING PROBLEMS Ph.D. Thesis**
Kuang-shi Ju 1975 97 p
Avail: Univ. Microfilms Order No. 75-26602

A modular upper bound technique for predicting the maximum required load in metal forming problems was developed. The procedure is based upon the upper bound theorem for rigid perfectly plastic solids. The use of this theorem guarantees that the predicted load will be an upper bound to the actual load, but requires that an admissible velocity field for the workpiece be known. The method applies to problems involving plane strain and axisymmetric flows, or combination of the two. Two different methods for determining admissible velocity fields for the elements are described and the conditions which the elements and their velocity fields must satisfy are discussed in detail. Velocity fields for twenty-two elements, which are considered to be most representative of those encountered in metal forming problems, are presented. Computer programs developed for calculating the deformation energy of each element, and slip energy on the surfaces of velocity discontinuity, and for connecting the various elements to obtain the total forming load are discussed. Dissert. Abstr.

**N76-14460*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**EXTERNALLY SUPPORTED INTERNALLY STABILIZED FLEXIBLE DUCT JOINT Patent**
James R. Rollins, inventor (to NASA) (Rockwell Intern. Corp., Canoga Park, Calif.) Issued 28 Oct. 1975 6 p Filed 27 Jun. 1974 Supersedes N74-34882 (12 - 24, p 2951) Sponsored by NASA
(NASA-Case-MFS-19194-1; US-Patent-3,915,482; US-Patent-Appl-SN-483850; US-Patent-Class-285-226; US-Patent-Class-285-265) Avail: US Patent Office CSCL 13E

An externally supported, internally-stabilized flexible duct joint is described which is particularly suited for use in conducting the flow of fluid between a pair of tubular conduits, at least one of which is supported for motion relative to the other. The joint is characterized by a low-flow loss coefficient and includes a pair of coaxially related terminal sleeves adapted to be coupled with adjacently disposed conduits, and an elongated bellows extended between the terminal sleeves. The bellows is supported against thrust induced extension by linkage including a gimbal ring concentrically related to the mid-span of the bellows and a pair of terminal supports affixed to the terminal sleeves and journaled to the gimbal ring. A bellows stabilizing sleeve is disposed within the bellows for avoiding flow impingement and preventing lateral shifting; a support ring is mounted on the stabilizing sleeve and connected to the mid-span of the bellows for connecting the bellows with the stabilizing sleeve.
Official Gazette of the U.S. Patent Office

**N76-14461*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**APPARATUS FOR FORMING DISHED ION THRUSTER GRIDS Patent**
Bruce A. Banks, inventor (to NASA) Issued 28 Oct. 1975 5 p Filed 22 Apr. 1974 Supersedes N74-22147 (12 - 13, p 1561) Division of US Patent Appl. SN-352381, filed 18 Apr. 1973, US-Patent-3,864,797
(NASA-Case-LEW-11694-2; US-Patent-3,914,969; US-Patent-Appl-SN-462903; US-Patent-Class-72-63; US-Patent-Class-72-363; US-Patent-Class-29-421; US-Patent-Class-72-54; US-Patent-Appl-SN-352381; US-Patent-3,864,797) Avail: US Patent Office CSCL 13H

The patent of an invention dealing with an apparatus for forming dished ion thruster grids was reported. The apparatus consists in an assembly of grid blanks which is separated and covered by impervious metal sheets. The assembly is placed on top of an elastic sheet, and the assembled sheets are clamped at their edges, preventing random slippage and forming an expansible fluid chamber. Pressurized fluid in this chamber inflates the elastic sheet which, in turn, forces the impervious sheets and grid blanks to dish to their natural contour which is approximately hemispheroidal. The impervious sheet between the grid blanks prevents distortion caused by slight misalignment of the holes in the screen and accelerator grids. The dished grids are stress relieved simultaneously in matched dies. Author

**N76-14462**+ Engineering Sciences Data Unit, London (England).
**FATIGUE STRENGTH OF TRANSVERSE FILLET AND CRUCIFORM BUTT WELDS IN STEELS**
Sep. 1975 23 p refs Sponsored in part by Inst. Mech. Engr. (ESDU-75016; ISBN-0-85679-120-2) Copyright. Avail: NTIS HC $242.50

Data are presented for assessing the fatigue strength of a fabricated steel structure containing transverse fillet or cruciform butt welds and to indicate ways in which to improve strength in the as-welded condition. The data are applicable to fabricated structure containing transverse fillet or cruciform butt welds such as locomotive chassis, commercial vehicles, ship and bridge structures; and from constant amplitude loading in a wide range of steels, for endurances between 10,000 and 10 to the 8th power cycles. The effects of variation in weld geometry, size and mean stress are included. Author

**N76-14463*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**QUICK DISCONNECT FILTER COUPLING Patent**
Fred Jankowski, inventor (to NASA) Issued 7 Oct. 1975 5 p Filed 30 May 1974 Supersedes N74-26988 (12 - 16, p 1923)
(NASA-Case-MFS-22323-1; US-Patent-3,910,307; US-Patent-Appl-SN-474745; US-Patent-Class-137-515.3; US-Patent-Class-137-550; US-Patent-Class-251-149.6; US-Patent-Class-210-429) Avail: US Patent Office CSCL 13E

A quick disconnect filter coupling is described for use in coupling a pair of lines together through which fluid passes. The device includes a male cylindrical housing having an enlarged longitudinal bore into which a filter cartridge is removably carried. The filter cartridge includes a filter medium and a check valve. A purge assembly can be attached to the male cylindrical housing for flushing with a cleansing fluid when changing the filter cartridge. Official Gazette of the U.S. Patent Office

**N76-14464*#** Rensselaer Polytechnic Inst., Troy, N.Y. Tribology Lab.
**EVALUATION OF MATERIALS AND DESIGN MODIFICATIONS FOR AIRCRAFT BRAKES**
T. L. Ho, F. E. Kennedy, and M. B. Peterson Jan. 1975 65 p refs
(Grant NGR-33-018-152)
(NASA-CR-134896) Avail: NTIS HC $4.50 CSCL 11G

A test program is described which was carried out to evaluate several proposed design modifications and several high-temperature friction materials for use in aircraft disk brakes. The evaluation program was carried out on a specially built test apparatus utilizing a disk brake and wheel half from a small het aircraft. The apparatus enabled control of brake pressure, velocity, and braking time. Tests were run under both constant and variable velocity conditions and covered a kinetic energy range similar to that encountered in aircraft brake service. The results of the design evaluation program showed that some improvement in brake performance can be realized by making design changes in the components of the brake containing friction material. The materials evaluation showed that two friction materials show potential for use in aircraft disk brakes. One of the materials is a nickel-based sintered composite, while the other is a molybdenum-based material. Both materials show much lower wear rates than conventional copper-based materials and are better able to

withstand the high temperatures encountered during braking. Additional materials improvement is necessary since both materials show a significant negative slope of the friction-velocity curve at low velocities. Author

**N76-14465#** Witwatersrand Univ., Johannesburg (South Africa). School of Mechanical Engineering.
**STIRLING CYCLE ENGINE DEVELOPMENT: A REVIEW**
I. Urieli and C. J. Rallis Jul. 1975 20 p refs
(ISBN-0-85494-327-7; Rept-61) Avail: NTIS HC $3.50

The elementary concepts of Stirling cycle machines, their historical development to date, and possible future applications are discussed. The high efficiency, versatility, low pollution, and nondiscriminatory energy input requirements of Stirling machines, assures them of a place in the spectrum of thermal devices -- both as prime movers and for heating and cooling purposes. Author

**N76-14466*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**EXPERIMENTAL PERFORMANCE OF 75-MILLIMETER-BORE ARCHED OUTER-RACE BALL BEARINGS TO 2.1 MILLION DN**
Harold H. Coe Washington Jan. 1976 17 p refs
(NASA-TN-D-8145; E-8504) Avail: NTIS HC $3.50 CSCL 13I

An experimental investigation was performed to determine the operating characteristics of arched outer-race bearings and to compare the data with those for a similar, but conventional, deep-groove ball bearing. The bearings were tested over a range of shaft speeds up to 28,000 rpm at a thrust load of 2200 newtons (500 lb). One bearing was operated at 26,000 rpm with a range of thrust loads. The amounts of arching were 0.13, 0.25, and 0.51 millimeter (0.005, 0.010, and 0.020 in.). All bearings operated satisfactorily; the arched bearing outer-race temperatures and torques were consistently higher than those for the conventional bearing. Author

**N76-14467*#** Shaker Research Corp., Ballston Lake, N.Y.
**INVESTIGATIONS OF A BEARING FAULT DETECTOR FOR RAILROAD BEARINGS**
Donald S. Wilson and John L. Frarey [1975] 46 p refs
(Contract NAS8-31449)
(NASA-CR-144114; Rept-75-TR-14) Avail: NTIS HC $4.00 CSCL 13F

The laboratory tests are described which were conducted on new and damaged bearings to determine the feasibility of using high-frequency vibration as a diagnostic tool. A high-frequency band pass filter and demodulator was assembled to permit field measurements of the high-frequency vibrations. Field tests were conducted on an actual truck and on an axle assembly run in a grease test rig. These field tests were directed toward demonstration of the suitability and capabilities of the high-frequency technique for field application. Two specific areas of field application were identified as being cost effective for railroad use. One area is the examination of railroad roller bearings at a derailment site, and the second is as a wayside detector to supplement present hot box detectors for defective roller bearings. Author

**N76-14468#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
**NYLASINT PORE SYSTEM, RESERVOIR OR SINK Interim Report**
Leon M. Dormant and Seymour Feuerstein 20 Jul. 1975 25 p refs
(Contract F04701-75-C-0076)
(AD-A013720; TR-0076(6270-30)-2; SAMSO-TR-75-205) Avail: NTIS CSCL 11/8

Porous nylon blocks are currently used as lubricant replenishment reservoirs in moving mechanical assemblies within communication satellites and other spacecraft that must have long mission lifetimes. This report presents theoretical and experimental evidence that the reservoir function is not fulfilled under isothermal conditions because of capillary effects. GRA

**N76-14469#** SACLANT ASW Research Center, La Spezia (Italy).
**A CABLE GLAND FOR DEEP-SEA OPERATION**
Bruno Miaschi 15 Jan. 1975 11 p ref Revised
(AD-A004842; SACLANTCEN-SM-58-Rev) Avail: NTIS CSCL 09/1

An underwater multi-cable gland is described which can be used for connecting sensors subject to hydrostatic pressure to electronic equipment located in pressure-resistant containers. In its present form, the gland is for use only with neoprene or rubber-sheathed cables. Author (GRA)

**N76-14470#** Honeywell, Inc., St. Louis Park, Minn. Government and Aeronautical Products Div.
**HYDRAULIC CONTROL HANDLE/ELEVATION AXIS CLOSED LOOP SYSTEM EVALUATION FLUIDIC ARMAMENT CONTROL SYSTEM Final Report, May 1974 - Jan. 1975**
R. V. Burton May 1975 48 p
(Contract DAAA09-74-C-2047; DA Proj. 1T1-62114-A-645)
(AD-A014001; RIA-R-CR-75-026; Rept-45891) Avail: NTIS CSCL 13/7

The investigation of Fluidic Armament Control System (FACS) mechanizations for combat vehicle stabilized-gun/turret-control system applications was initiated in 1968 based on the need for developing low-cost systems. The accomplishments in this program result from effort, conducted on three limited-scope contracts over the 1968-1974 time frame, to demonstrate for the first time the closed-loop operation of an all-fluidic stabilized gun tracking system. A laboratory demonstration was conducted of an elevation axis system. GRA

**N76-14471#** Grumman Aerospace Corp., Bethpage, N.Y.
**EXPLORATORY DEVELOPMENT OF WELD QUALITY DEFINITION AND CORRELATION WITH FATIGUE PROPERTIES Final Report, 29 Sep. 1972 - 31 Oct. 1974**
Robert Witt and Olev Paul Apr. 1975 243 p refs
(Contract F33615-72-C-2039; AF Proj. 7381)
(AD-A013923; AFML-TR-75-7) Avail: NTIS CSCL 13/5

The purpose of this program was to conduct an exploratory evaluation of the effects of typical weld anomalies on fatigue endurance of Ti-6Al-4V titanium alloy weldments and to propose criteria for acceptance/rejection of titanium fusion welds. GRA

**N76-14472#** Battelle Columbus Labs., Ohio.
**HYDROGEN IN HY-130 METAL Annual Report, Jun. 1974 - Jul. 1975**
D. G. Howden and P. A. Tews 31 Jul. 1975 41 p refs
(Contract N00014-74-C-0407; NR Proj. 031-770)
(AD-A013601; AR-1) Avail: NTIS CSCL 13/8

This report summarizes the first years investigation directed at improving the mechanical properties of HY-140 weld metal by controlling hydrogen contamination. The addition of 0.2 percent hydride formers (Misch Metal) to weld metal has been shown to eliminate diffusible hydrogen at room temperature when the argon arc shielding gas was contaminated to a 5 percent level. The hydrides formed were stable on heating to a temperature of 760 C. Misch Metal at the 0.1 percent level in the filler wire was transferred to the weld metal with an efficiency of about 20 percent and no change in metal transfer characteristics was noted. Wire with greater than 0.1 percent Misch Metal proved difficult to fabricate with the techniques investigated. Author (GRA)

**N76-14473#** Rock Island Arsenal Lab., Ill. General Thomas J. Rodman Lab.
**A VACUUM-FORMING PROCESS FOR MANUFACTURING WEAPON ACCESSORIES FROM COATED FABRICS Technical Report, Dec. 1971 - Aug. 1974**
Thomas J. Koehler Dec. 1974 21 p
(AD-A013860; RIA-R-TR-75-004) Avail: NTIS CSCL 13/8

Selected vacuum-forming techniques were used to fabricate test parts from coated fabrics. A technique in which a secondary ring-die approach is used was successful in eliminating fabrication problems such as webbing, nonuniform wall thickness and material thinout or deterioration. Elastic knit or heat-stretchable woven substrates coated with polyether urethane or ethylene vinyl acetate were acceptable materials for the fabricating of test parts. The coated nonwoven substrates evaluated could not be vacuum-formed because of low-stretch characteristics. Materials successfully vacuum-formed did not meet strength requirements

of MIL-C-20696, Cloth, Coated, Nylon, Waterproof. Heavier materials that met strength requirements were only partially vacuum-formable with the use of laboratory equipment. These materials could potentially be completely molded by production scale vacuum formers. GRA

**N76-14289*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 3: GAS TURBINES IN THE PRODUCTION OF ELECTRIC POWER**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 52-84 refs (For availability see N76-14286 05-31)
CSCL 21E

# 38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

**N76-14474** Colorado State Univ., Fort Collins.
**DEFECT CHARACTERIZATION BY MAGNETIC LEAKAGE FIELDS Ph.D. Thesis**
Jackson Her-Nan Hwang 1975 258 p
Avail: Univ. Microfilms Order No. 75-26416

The application is discussed of finite element techniques for the study of magnetic field/defect interactions. Finite element approximating equations for the interactions between magnetic fields and defects were obtained through the minimization of an energy functional with discrete shape functions. Since the iteration process is needed in finite element methods to solve nonlinear magnetic circuits, a four-equation cubic function for the effective modeling of B/H curves and fast convergence scheme by the tangent line method are described and used to achieve fast convergence of iteration. Analysis of the simulated leakage magnetic field patterns, which result from the interactions of magnetic fields with defects, shows that the characterization of a surface defect is possible, but the determination of the size, shape, and location of a subsurface flaw or the detection of the second layer flaw in a double-layer defect is impossible.
Dissert. Abstr.

**N76-14475*#** Martin Marietta Aerospace, Denver, Colo.
**THE DETECTION OF TIGHTLY CLOSED FLAWS BY NONDESTRUCTIVE TESTING (NDT) METHODS Final Report, Jun. 1973 - Oct. 1975**
Ward D. Rummel, Richard A. Rathke, Paul H. Todd, Jr., and Steve J. Mullen Oct. 1975 189 p ref
(Contract NAS9-13578)
(NASA-CR-144639; MCR-75-212) Avail: NTIS HC $7.50 CSCL 14D

Liquid penetrant, ultrasonic, eddy current and X-radiographic techniques were optimized and applied to the evaluation of 2219-T87 aluminum alloy test specimens in integrally stiffened panel, and weld panel configurations. Fatigue cracks in integrally stiffened panels, lack-of-fusion in weld panels, and fatigue cracks in weld panels were the flaw types used for evaluation. A 2319 aluminum alloy weld filler rod was used for all welding to produce the test specimens. Forty seven integrally stiffened panels containing a total of 146 fatigue cracks, ninety three lack-of-penetration (LOP) specimens containing a total of 239 LOP flaws, and one-hundred seventeen welded specimens containing a total of 293 fatigue cracks were evaluated. Nondestructive test detection reliability enhancement was evaluated during separate inspection sequences in the specimens in the 'as-machined or as-welded', post etched and post proof loaded conditions. Results of the nondestructive test evaluations were compared to the actual flaw size obtained by measurement of the fracture specimens after completing all inspection sequences. Inspection data were then analyzed to provide a statistical basis for determining the flaw detection reliability.
Author

**N76-14476#** Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
**AN INTRODUCTION TO FAULT-TOLERANT DESIGN TECHNIQUES**
Thomas E. Tyson Jun. 1975 38 p refs
(AF Proj. 2003)
(AD-A013934; AFAL-TR-74-334) Avail: NTIS CSCL 09/3

This report introduces the concept of fault-tolerant architectures and surveys general techniques for the design of fault-tolerant systems. The techniques discussed are for digital systems or systems that can be visualized as being digital in nature. GRA

**N76-14477#** Shaker Research Corp., Ballston Lake, N.Y.
**RELIABILITY MODEL FOR MINIATURE BLOWERS PER MIL-B-23071B Final Report, Feb. 1974 - Mar. 1975**
Donald S. Wilson and John W. Wilkinson Jul. 1975 129 p refs
(Contract F30602-74-C-0131; AF Proj. 5519)
(AD-A013735; RADC-TR-75-178) Avail: NTIS

A statistical review of life test failure data of over 2000 electronic cooling fans and blowers covered by MIL-B-23071B was conducted. The approach followed and the results obtained are discussed. A mathematical reliability model was established for the prediction of blower life as a result of the analysis. A procedure is presented for predicting the mean time to failure and failure rate of miniature fans and blowers. GRA

**N76-14478#** Pennsylvania State Univ., University Park. Dept. of Statistics.
**CHOICE OF MODEL FOR RELIABILITY STUDIES AND RELATED TOPICS, 3 Final Technical Report, 1 Jul. 1973 - 30 Jun. 1974**
Charles E. Antle and Lawrence A. Klimko Jun. 1975 82 p refs
(Contract F33615-73-C-4080; AF Proj. 7071)
(AD-A014085; ARL-75-0133) Avail: NTIS CSCL 14/4

This report contains the results of studies of maximum likelihood estimation for the lognormal and gamma models, with emphasis upon the establishment of the existence and uniqueness of the estimators. In addition, ratio of maximized likelihoods tests and modifications of these tests are presented for problems in discriminating among Weibull, lognormal and normal distributions. Tables of critical values and powers are given for some of these tests including in particular the tests for normal vs. lognormal (3 unknown parameters) with complete samples, and tests for Weibull vs. lognormal (2 unknown parameters) with censored or complete samples. These tests are shown to be nearly as powerful as any invariant test. Some consideration is also given to the problem of choosing either the three parameter Weibull or the three parameter lognormal as a model. GRA

**N76-14479#** George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
**INFERENCE FROM ACCELERATED LIFE TESTS USING THE INVERSE POWER LAW MODEL**
Nozer D. Singpurwalla and Faiz A. AlKhayyal 30 Jun. 1975 36 p refs
(Contracts N00014-75-C-0729; F33615-74-C-4040; NR Proj. 347-020)
(AD-A013678; Serial-T-318) Avail: NTIS CSCL 14/2

Parameters of the Power Rule Model, and the shape parameter of the Weibull distribution are estimated using data from censored sample life tests conducted at accelerated environments. Two approaches to the maximum likelihood method are considered; one is based on the observed time to failure and the other is based on the maximum likelihood estimators of the Weibull scale and shape parameters. The behavior of the likelihood function for the latter approach is examined in good detail. The asymptotic normality of these estimators is ascertained by examining the shapes of the relative likelihood functions. Inference about the Weibull scale parameter at use conditions environment is discussed. A numerical example based on accelerated life test data is presented and discussed. Author (GRA)

**N76-14480#** Adaptronics, Inc., McLean, Va.
**ADAPTIVE NONLINEAR SIGNAL PROCESSING FOR CHARACTERIZATION OF ULTRASONIC NDE WAVEFORMS. TASK 1: INFERENCE OF FLATBOTTOM HOLE SIZE Interim Report, 1 May 1974 - 31 Jan. 1975**
Anthony N. Mucciardi, Ramesh Shankar, John Cleveland, William

E. Lawrie, and Henrie L. Reeves Feb. 1975 94 p refs (Contract F33615-74-C-5122; AF Proj. 7351) (AD-A013881; AFML-TR-75-24; Rept-687) Avail: NTIS CSCL 14/2

The overall objective of this first work task was to demonstrate feasibility of adaptive nonlinear signal processing techniques, from cybernetics and bionics, applied to characterization of ultrasonic nondestructive testing (UNDT) waveforms for accurate inferences of flat-bottom hole sizes. The classified waveforms were ultrasonic pulse echoes obtained from 2 different sets of 7075-T6 aluminum test blocks and 3 different transducers. The eight flat-bottom hole defect sizes ranged from 1/64 to 8/64 inch in steps of 1/64 inch. GRA

# 39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

**N76-14481** Shock and Vibration Information Center (Defense), Washington, D.C.
**THE SHOCK AND VIBRATION DIGEST, VOLUME 7, NO. 8**
Aug. 1975 111 p refs
(AD-A013438) Avail: Paper copy available from Shock and Vibration Center, Naval Research Lab., Code 6020, Washington, D. C. 20390. Annual subscription $40.00

A publication is presented which contains abstracts on structural engineering and vibration for scientists and engineers in aerospace, aeronautical, and mechanical engineering. Analysis and design techniques (algorithms, mathematical models, computer programs) are examined for many kinds of structures, such as spacecraft structures, buildings, plates, shells, aircraft structures, machine tools, and automobiles. The spin dynamics and vibration of spacecraft were also considered. For individual titles, see N76-14482 through N76-14485.

**N76-14482** California Univ., Santa Barbara.
**PARAMETER UNCERTAINTY IN DYNAMIC SYSTEMS**
W. T. Thomson *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 7, No. 8 Aug. 1975 p 3-9 refs (For availability see N76-14481 05-39)
(Grants NSF GK-743; NSF GK-21403)

A compilation of abstracts is presented for structural dynamics and vibration for use in the disciplines of aerospace engineering, aeronautical engineering, and mechanical engineering. Some examples of areas covered are: (1) space vehicles, aircraft, missiles, and commercial transportation (automobiles, trucks), (2) structures (buildings, plates, and shells), (3) composite materials, and (4) seismology and related activities. Analysis and design techniques are examined (such as dynamic programming, mathematical models, computer programs, algorithms, etc), and a listing of engineering journals is given. J.R.T.

**N76-14483** Virginia Polytechnic Inst. and State Univ., Blacksburg.
**ON THE MODAL ANALYSIS FOR SPINNING STRUCTURES**
L. Meirovitch *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 7, No. 8 Aug. 1975 p 71-75 refs (For availability see N76-14481 05-39)

Various mathematical techniques and models for analysis of spacecraft spin dynamics and vibration (gyroscopic systems) are examined. Variations of the Rayleigh-Ritz method are discussed and examples are given (i.e., differential equations of motion, eigenvalues, degrees of freedom, algorithms, etc.). J.R.T.

**N76-14484** Comsat Labs., Clarksburg, Md.
**NONSTATIONARY AND NONLINEAR VIBRATION ANALYSIS AND ITS APPLICATION**
B. N. Agrawal *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 7, No. 8 Aug. 1975 p 77-87 refs (For availability see N76-14481 05-39)

Some of the techniques used to analyze nonstationary and nonlinear vibration are briefly reviewed. The first asymptotic approximation solution is presented for general resonances in a nonlinear, nonstationary, multiple degree-of-freedom system. The application of nonstationary analysis to spacecraft vibration testing is also discussed. Equations of motion are developed. Author

**N76-14485** Massachusetts Inst. of Tech., Cambridge.
**A LITERATURE REVIEW OF THE DYNAMIC PLASTIC RESPONSE OF STRUCTURES**
Norman Jones *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 7, No. 8 Aug. 1975 p 89-105 refs (For availability see N76-14481 05-39)
(Contract N00014-67-A-0204-0032; Grant NSF GK-38562)

A literature review is presented of the stable inelastic response of structural members (beams, plates and shells) subjected to dynamic loads which cause permanent displacements or damage of a structure. A dynamic load causes stress waves to propagate through the thickness of this class of structures as well as producing an overall structural response. The propagation of stress waves through the structural thickness can cause failure by spalling, or delamination of composite structures, when the shock or impact loads are sufficiently severe. Specifically, the long-term behavior (typically of the order of milliseconds) of structures is examined for which the external dynamic load is assumed to impart momentum instantaneously to the middle surface of a structure. Also examined are friction and vibration in machine tools (book reviews). Author

**N76-14486**+ Engineering Sciences Data Unit, London (England)
**GEOMETRIC STRESS CONCENTRATION FACTORS: TWO ADJACENT UNREINFORCED CIRCULAR HOLES IN INFINITE FLAT PLATES**
Jun. 1975 9 p ref Supersedes ESDU-66035 Sponsored by Inst. of Mech. Engr. and Roy. Aeron. Soc.
(ESDU-75007; ESDU-66035) Copyright. Avail: NTIS HC $74.50

Data are presented to provide the maximum elastic stress that occurs at the perimeter of two adjacent unequal holes in plates subjected to various in-plane loadings. A typical application includes shear webs of support beams containing circular ducting apertures. The range of applicability is the ratio of hole diameters up to 10 with ratio of small hole radii to the distance of the center of the small hole from the perimeter of the large hole up to 0.9. Data are also applicable to plates where no boundary is closer than four times the radii of the larger hole. Author

**N76-14487** Michigan State Univ., East Lansing.
**IMPROVEMENT IN PLATE MODELING AND PLATE DESIGN BY THE FINITE ELEMENT METHOD Ph.D. Thesis**
Cheng-kong Chou 1975 259 p
Avail: Univ. Microfilms Order No. 75-27251

A study was conducted (1) to develop refinded finite element computer programs for plane stress and plate bending with the plan that these can be combined in the future for use in folded plate analysis, especially for the complex nonprismatic multiple-folded plate structures, (2) to compare analysis results using the refined elements with results of the standard ELAS program, and (3) to apply the standard program to study some possibilities in optimization in design of a uniformly loaded, clamped, or simply-supported square plate. Dissert. Abstr.

**N76-14488** Polish Academy of Sciences, Warsaw.
**FINITE ELEMENT APPROXIMATION METHOD (ON THE EXAMPLE OF ELASTIC SYSTEMS). PART 1: DESCRIPTION OF THE METHOD [APROKSYMACYJNA METODA ELEMENTOW SKONCZONYCH (NA PRZYKLADZIE UKLADOW SPREZYSTYCH)]**
Wiktor Gambin 12 Apr. 1975 76 p refs In POLISH
Avail: Issuing Activity

An appromimation method is described and discussed in detail. Other topics discussed include the geometric elements of the construction system investigated, elements in the boundaries, the system's structure, vector fields, linear elastic systems, plane deformation, and three dimensional axisymmetric problems. Transl. by M.J.S.

**N76-14489** Georgia Inst. of Tech., Atlanta.
**THERMAL EFFECTS IN THE PARAMETRIC EXCITATION**

**OF THIN PLATES Ph.D. Thesis**
Parthasarathi Mukhopadhyay 1975 104 p
Avail: Univ. Microfilms Order No. 75-26213

A study was conducted to investigate the effect of thermal stresses on stability of parametric excitation of thin plates. The governing equations are derived using the principle of virtual work with reference to a general orthogonal curvilinear coordinate system. An assumed modes method was used to obtain the equations of motion in terms of generalized coordinates. The method developed was applied to the study of the dynamic stability of a simply supported rectangular plate and a clamped circular plate. In both cases the influence of thermal stresses on the principal region of instability was examined. Solution of the axisymmetric thermal buckling problem of the circular plate is also presented. Dissert. Abstr.

**N76-14490** Tennessee Univ., Knoxville.
**DYNAMIC ANALYSIS OF A PENDULOUS SUSPENSION SYSTEM Ph.D. Thesis**
Joseph Ninan Kanianthra 1975 170 p
Avail: Univ. Microfilms Order No. 75-26721

The potential of a pendulous suspension system in providing lateral vibration isolation in high speed passenger rail cars is investigated. The effect of various suspension parameters on ride comfort and speed is established. An optimum set of vehicle suspension parameters is selected. It is concluded that the proposed pendulous suspension system is capable of achieving lateral attenuation of vibration when lateral and vertical sinusoidal wheel inputs are applied. Dissert. Abstr.

**N76-14491** Washington Univ., Seattle.
**LINEAR ELASTIC FRACTURE ANALYSIS BY AN ASSUMED DISPLACEMENT HYBRID FINITE ELEMENT METHOD Ph.D. Thesis**
Michihiko Nakagaki 1974 196 p
Avail: Univ. Microfilms Order No. 75-28410

An assumed displacement hybrid finite element procedure was developed for solving two-dimensional, linear elastic fracture mechanics problems with isotropic and anisotropic materials and mixed-mode crack surface deformations. Nodal displacements and the elastic stress intensity factors were directly determined as unknowns in the finite element analysis. The accuracy of the developed procedure was checked by analyzing problems with known solutions which include centrally cracked isotropic and orthotropic tension plates, a single edge-notched tension plate, an oblique edge-notched tension plate, and tension plates with one-quarter circular crack. The procedure was applied to solve problems for which theoretical solutions are not available. These problems include doubly edge-notched orthotropic tension plates, an orthotropic three-point bend specimen, an orthotropic tension plate with slanted crack, and a centrally cracked bimaterial tension plate. Dissert. Abstr.

**N76-14492** Washington Univ., Seattle.
**SHEAR AND MOMENT TRANSFER BETWEEN REINFORCED CONCRETE FLAT PLATES AND COLUMNS Ph.D. Thesis**
Jun Yamazaki 1975 308 p
Avail: Univ. Microfilms Order No. 75-28473

An incremental finite element method of analysis was used to evaluate the stress redistribution up to collapse of slab to column connections. Results obtained from that analysis were compared with the behavior observed in tests on six slab-column specimens, containing shear reinforcement. Good agreement was obtained between the predicted progress of cracking and yielding with increasing load and that observed in the tests. The analysis and tests show effects of redistribution of moments markedly differing from the elastic behavior. Results also suggest a difference in a strength criterion for reinforced concreted elements built into the slab from that for elements with free boundaries. The analytical work reported permits calculation of stresses on a critical section. Bases were given for a rational prediction of ultimate strengths of slab to column connections. Dissert. Abstr.

**N76-14493** Virginia Univ., Charlottesville.
**DESIGN OF BUILDING FLOOR SYSTEMS SUBJECTED TO STEADY-STATE DYNAMIC LOADS Ph.D. Thesis**
Donald Wayne Vannoy 1975 172 p
Avail: Univ. Microfilms Order No. 75-28065

The design of long span light-weight floor systems where the problem of uncomfortable vibrations must be considered was discussed. Ordinary structural design practice ignores vibration effects. The objective is to present, in the form of proposed design guides, a relationship between allowable live load deflection and induced frequency of vibration of the live load. With these design guides, an engineer can quickly check the suitability of the floor system under steady-state loading in addition to the conventional design controls. Dissert. Abstr.

**N76-14494** Kentucky Univ., Lexington.
**LOCAL BUCKLING OF PLATES AND SECTIONS OF FLEXURAL MEMBERS UNDER STRESS GRADIENT Ph.D. Thesis**
Yei-Lung Tien 1975 183 p
Avail: Univ. Microfilms Order No. 75-26483

The local buckling behavior of simply supported wide flange and rectangular box section beams subjected to moment gradients due to a concentrated or a uniform load is investigated. The stresses in the structural elements and members due to moment gradients are not uniform. The longitudinal compressive stress in the compression flange varies continuously along the length of the beam and is combined with the associated shearing and transverse stresses. The longitudinal compressive stress in the web varies linearly across the depth of the section and is also associated with the changing shearing stress. The stresses in the tension flange have the same pattern as in the compression flange. In the first part, the local buckling of the compression flanges subjected to the stress gradients as well as elastically restrained boundary conditions along the joint edges is studied. In the second part, the buckling behavior of beam sections is studied. Dissert. Abstr.

**N76-14495** New Mexico Univ., Albuquerque.
**THE INFLUENCE OF REPETITIVE LOADING ON FLEXIBLE PAVEMENT RESPONSE Ph.D. Thesis**
Todd Darrah Stong 1975 435 p
Avail: Univ. Microfilms Order No. 75-28726

The approach was to test a specially prepared and controlled bituminous flexible pavement periodically during its trafficking by a 15,000-lb. single wheel load for 10,000 passages. The pavement was nondestructively tested with a heavy, wide frequency range, surface vibrator system. Elastic moduli interpreted from surface vibrator data were directly compared to moduli gained from a cross-hole wave propagation system installed within the pavement. These moduli were then inputed to a finite-element pavement code where stresses and strains were calculated. Verification of these calculated quantities was obtained from stress and strain instrumentation installed in the pavement. Dynamic deflection and pavement stiffness values derived from other surface vibrator tests were also related to the wave propagation tests and to stresses and strains observed. It was demonstrated that through the use of both cross-hole and surface vibrator techniques, changes in individual pavement layer moduli are observable throughout the life of a pavement. Dissert. Abstr.

**N76-14496** Ohio State Univ., Columbus.
**A STUDY OF THE TRANSIENT PHENOMENA OF A VISCOELASTIC MATERIAL Ph.D. Thesis**
Yoon Soo Song 1975 291 p
Avail: Univ. Microfilms Order No. 75-26668

The kinetic-elastic model developed by Brodkey and coworkers to describe nonNewtonian viscoelastic phenomena is expressed by a set of equations. Three transient phenomena were chosen to test the proposed model. They were the shear stress growth on onset of constant shear rate, the shear stress relaxation on cessation of shear rate, and the shear rate variation under constant shear stress. The transient data were obtained at a digitizing rate of 1 kHz by utilizing a PDP-15 computer. The material systems studied were 35% and 40% (weight) polymethyl methacrylate in diethyl phthalate. The apparent viscosity ranged from 1000 to a little over 100000 poises under experimental conditions. At the low concentration of polymer solution, the kinetic-elastic model predicted satisfactorily the three transient phenomena. At the high concentration, the model was only partially successful; it could predict individual transient phenom-

enon, but was incapable of predicting all the phenomena at the same time. Dissert. Abstr.

**N76-14497** Southern Methodist Univ., Dallas, Tex.
**EFFECT OF PREBUCKLING DEFORMATIONS ON BUCKLING OF LAMINATED COMPOSITE CIRCULAR CYLINDRICAL SHELLS Ph.D. Thesis**
Jose Carlos Ferraz Hennemann 1975 157 p
Avail: Univ. Microfilms Order No. 75-29143

The influence of prebuckling deformations on the axial and lateral pressure buckling loads of circular cylindrical shells made of fiber-reinforced composite laminates was investigated. The rigorous solution (with actual prebuckling deformations) is compared to the classical solution (with membrane prebuckling deformations) for corresponding shells. The effects of prebuckling deformation on axial buckling loads decreases as the orthotropy ratio increases, and as the laminate coupling stiffnesses decrease. For lateral pressure, the effect of prebuckling deformations decreases as the orthotropy ratio increases. For this loading, as the laminate coupling stiffnesses decrease, the effect of prebuckling deformations increases up to a constant level. Variations in the eleastic as well as geometric parameters were studied numerically for both antisymmetric and unsymmetric laminates. For laminated shells, the effect of prebuckling deformations is to change the actual buckling load relative to the classical buckling load by less than 8%. The prebuckling effect is less important for laminated shells than for isotropic shells. Dissert. Abstr.

**N76-14498** Clarkson Coll. of Technology, Potsdam, N.Y.
**INELASTIC LARGE DEFORMATION RESPONSE OF CRASH-IMPACTED STRUCTURAL SYSTEMS WITH LARGE INERTIA EFFECTS Ph.D. Thesis**
Kwang-Chun Park 1975 152 p
Avail: Univ. Microfilms Order No. 75-26121

Formulation and solution techniques are developed and evaluated for crash-impacted structures with large inertia elements as the dominating source of the system response. The total system is first grouped into: large rigid-body elements, deformable structures, and constraining interfaces. The constraining interfaces include, via Lagrangian multipliers, the coupling mechanisms between rigid elements and deformable structures, and boundary conditions between the total system and its boundaries. The principles of virtual work and the finite element method are applied to obtain two sets of coupled equations of motion for crash-impacted structures. The first set of equations represents the response of large inertia elements under external loads and constraint forces associated with Lagrangian multipliers which involve the effects of deformable elements. The second set of equations represents deformable structure which usually consists of large degrees of freedom. Dissert. Abstr.

**N76-14499** Cornell Univ., Ithaca, N.Y.
**RESONANCE PHENOMENA IN THE NONLINEAR VIBRATION OF PLATES GOVERNED BY DUFFING'S EQUATION Ph.D. Thesis**
William Joseph Parzygnat 1975 151 p
Avail: Univ. Microfilms Order No. 75-27491

It is shown that the frequency of oscillation of the system, during the amplitude jumps, does not stay equal to the driving frequency. The motion, although still oscillatory, undergoes rapid changes of amplitude, period and phase, and at the end of the transition, the system returns to steady state oscillations. This transient, oscillatory response of a nonlinear system may be expressed as the product of an amplitude function and cosine (or sine) of a phase function. The time derivative of the phase function is defined as the response frequency of the system. The amplitude function and the phase function of the response during either transient or steady state may be evaluated by applying the method of Krylov, Bogoliubov and Mitropolsky (KBM method). These functions satisfy two simultaneous nonlinear ordinary differential equations which are solved numerically, using the Runge-Kutta method. The nonlinear oscillations of a clamped circular plate, under harmonic excitation, were experimentally observed in order to determine the transient motion during the amplitude jumps at resonance. Dissert. Abstr.

**N76-14500** New Mexico Univ., Albuquerque.
**STRESSES AT THE TIPS OF CRACKS EMANATING FROM THE LOADED FASTENER HOLE Ph.D. Thesis**
Venkataraman Shivakumar 1975 78 p
Avail: Univ. Microfilms Order No. 75-28675

Stress-intensity factors, K, are obtained at the tips of radial cracks emanating from the boundary of an internal circular fastener hole in a plate loaded by a pin or rivet that just fills the hole and is pulled in the negative y-direction, in the plane of the plate. Solutions are obtained in conformally mapped region in the form of series for different crack lengths and are based on the Muskhelishvili formulation in the two-dimensional theory of elasticity. The method presents a general technique for determining K for k symmetrically located radial cracks of equal length for a wide variety of boundary tractions. Tractions on the crack edges, both concentrated and distributed, fall within the scope of this method. Dissert. Abstr.

**N76-14501** New Mexico Univ., Albuquerque.
**STRESS CONCENTRATION AROUND AN ELLIPTICAL HOLE AND STRESS DISTRIBUTION AROUND A CRACK IN THE PRESENCE OF COUPLE-STRESSES Ph.D. Thesis**
Wen-Jeng Wang 1975 124 p
Avail: Univ. Microfilms Order No. 75-28691

Couple-stress solutions were obtained for an elliptical hole in a biaxial field of stress, and the stress distribution at the base of a stationary crack. Linearized two-dimensional couple-stress theory of elasticity is employed. Modified boundary collocation method and the least square method were used to investigate the problem of an infinite plate interiorly bounded by an elliptical hole under various biaxial loads at infinity. Solutions were obtained for elliptical holes with the ratio of major to minor axis up to 2. Current solutions agree well with some existing solutions. The functional forms of stress and couple-stress distribution were established at the base of a stationary crack free from tractions by considering a semi-infinite cut and utilizing the extended Williams' method. The results are found to be identical to those obtained by Sternberg and Muki. Approximate forms of stress concentration factors were obtained for ellipses with various eccentricities. Approximate stress intensity factor is included for the corresponding degenerate crack problem. Dissert. Abstr.

**N76-14502** Michigan Univ., Ann Arbor.
**NONLINEAR EQUILIBRIUM AND STABILITY OF THIN-WALLED OPEN BEAMS Ph.D. Thesis**
Larry James Julyk 1975 157 p
Avail: Univ. Microfilms Order No. 75-29255

A technical theory for the nonlinear equations of equilibrium and stability of open thin-walled elastic beams was developed through a variational approach. The theory is nonlinear with respect to the angle of twist, accounting for the nonlinear coupling between torsional and flexural deformation. It is linear with respect to flexural deformation. A general solution procedure for the buckling problem is given. The procedure includes the effect of prebuckled deformations which are obtained from the beam column equations of equilibrium. The effect of boundary conditions was investigated through a number of numerical examples. The interaction of transverse and axial loading is also treated. Dissert. Abstr.

**N76-14503** Ohio State Univ., Columbus.
**AN APPROXIMATE SOLUTION FOR SWEEP FREQUENCY VIBRATION PROBLEMS Ph.D. Thesis**
Leonard Chiuan-Lin Sung 1975 108 p
Avail: Univ. Microfilms Order No. 75-26673

A method of approximate solution for the steady state response of linear time-invariant systems with variable frequency sinusoidal inputs is presented. The system transmissibility is in the form of an infinite series involving the system transfer function and its derivatives with respect to frequency and the function describing the variation of the excitation frequency and its time derivatives. It was shown that when the exciting frequency is slowly varying, the convergence of the series is sufficiently rapid that only the first few terms in system transmissibility need to be retained. The accuracy of the method of solution was demonstrated by applying it to the example of a single, damped, linear oscillator and comparing the results with those obtained by direct numerical integration of the governing

differential equation of motion. The approximate solutions were found to be highly accurate for slow sweep rates and indicative of the capability of the method of solution presented.
Dissert. Abstr.

**N76-14504** British Library Lending Div., Boston Spa (England).
**FEATURES OF RADIAL DEFORMATION OF A SYSTEM OF FLAT PLATES, COMMUNICATION 2**
L. G. Kostin and V. A. Belyi [1975] 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaveb., Chern. Met. (USSR), no. 3, 1975 p 102-105
(BLL-Trans-25189-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A formula was obtained for determining the specific forces in the radial plastic deformation of a long circular cylinder with a system of n-symmetrically arranged plates (n = 2, 3, 4 ...), being a closed, shape-forming hollow. It is shown that the generally-known case of upsetting two plane-parallel plates (n = 2) is a partial case of the deformation of a system of plates.
Author

**N76-14505** City Univ. of New York.
**THE NON-LINEAR BENDING OF A CLAMPED CIRCULAR PLATE UNDER UNIFORM NORMAL PRESSURE Ph.D. Thesis**
Johny Hellmann 1975 65 p
Avail: Univ. Microfilms Order No. 75-28085

A theoretical and numerical analysis is presented for the elastic deflections and stresses of an initially flat circular plate with clamped fixed edge, under uniform normal pressure. In considering large deflection bending, i.e., deflections up to several thicknesses of the plate, two coupled partial differential equations are given. An approximative solution is attempted of these equations by representing each of the unknown functions of these equations as a formal series of eigenfunctions. The most natural set of eigenfunctions, the Bessel functions of index one, each of which individually satisfies all but one of the boundary conditions are chosen. Deflection and stress results are calculated by means of computer methods.
Dissert. Abstr.

**N76-14506** Georgia Inst. of Tech., Atlanta.
**PARAMETRIC OSCILLATIONS OF A NOTCHED COLUMN Ph.D. Thesis**
Vijaykumar Navnitlal Parekh 1975 175 p
Avail: Univ. Microfilms Order No. 75-26215

Using Lagrange's equations, the equations of motions for column simply supported at both ends under axial load P(t) = P sub o + P sub 1 cos theta were derived. The approximate formulae for the parametric stability, the free vibration frequency, and the buckling load were obtained using the method of successive approximations (these formulae apply to a column with a region of discontinuity). The effects of a region of discontinuities on the column were evaluated in terms of three parameters, the size of the discontinuity, the effective stiffness, and the location of the discontinuity. These effects are reported in a nondimensional form. A two part experimental program was conducted to evaluate the effective stiffness parameter and the parametric stability results. These experimental results were correlated with the analytically deduced results. The experimental and the analytical stability results were in good agreement.
Dissert. Abstr.

**N76-14507** Shock and Vibration Information Center (Defense), Washington, D.C.
**THE SHOCK AND VIBRATION DIGEST, VOLUME 7, NO. 7**
Jul. 1975 123 p refs
(AD-A013437) Avail: Paper copy available from Shock and Vibration Center, Naval Research Lab., Code 6020, Washington, D. C. 20390. Annual subscription $40.00

Contents covered are: (1) news briefs; (2) application of skeleton curves and limit envelopes to analysis of nonlinear vibration; (3) analysis and design, computer programs, environments, phenomenology, experimentation, components, systems; (4) author index; (5) literature review; and (6) book reviews. For individual titles, see N76-14508 through N76-14511.

**N76-14508** National Research Inst. for Machine Design, Bechovice (Czechoslovakia).
**THE APPLICATION OF SKELETON CURVES AND LIMIT ENVELOPES TO ANALYSIS OF NONLINEAR VIBRATION**
A. Tondl *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 7, No. 7 Jul. 1975 p 3-20 refs (For availability see N76-14507 05-39)

The advantages of using skeleton curves and especially limit envelopes in qualitative analyses of nonlinear systems excited either by an external harmonic force or parametrically are discussed. These two auxiliary curves, which are established more readily than the resonance curves, make it possible to perform a number of considerations illuminating the effect of various system parameters and form a picture of the course of the resonance curves. They are shown to be applicable also to systems for which they have not previously been used. Some of the properties of the limit envelopes which are typical for certain kinds of damping are pointed out and a proposal for employing them in the identification of damping is presented. Even though not practically verified so far, this new approach could stimulate further efforts and aid the search for new methods in damping research.
Author

**N76-14509** Fruehauf Corp., Detroit, Mich.
**SHOCK AND VIBRATION ANALYSIS USING FINITE ELEMENT TECHNIQUES**
T. V. Seshadri *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 7, No. 7 Jul. 1975 p 75-95 refs (For availability see N76-14507 05-39)

Before going into the details of vibration and shock analysis via the finite element method, various classical methods are considered as an aid to a better appreciation of the finite element method.
Author

**N76-14510** Naval Postgraduate School, Monterey, Calif.
**TRANSONIC BLADE FLUTTER: A SURVEY**
M. F. Platzer *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 7, No. 7 Jul. 1975 p 97-106 refs (For availability see N76-14507 05-39)

Jet engine performance improvements due to increased tip speeds, composite blades, lighter disks and blades may seriously affect the engine's structural integrity and, in particular, may cause dangerous flutter problems. Theoretical and experimental investigations into transonic flutter are described.
Author

**N76-14511** Southwest Research Inst., San Antonio, Tex.
**APPROXIMATE TECHNIQUES FOR PLASTIC DEFORMATION OF STRUCTURES UNDER IMPULSIVE LOADING**
W. E. Baker *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 7, No. 7 Jul. 1975 p 107-117 refs (For availability see N76-14507 05-39)

Methods for making approximate predictions of dynamic structural deformations which allow solutions without recourse to extensive numerical methods or computer programs are considered. Some of the techniques discussed give predictions of time histories of plastic deformation while others only yield estimates of final deformed states.
Author

**N76-14512*#** Clemson Univ., S.C. Dept. of Mechanical Engineering.
**CRACK GROWTH IN BONDED ELASTIC HALF PLANES Final Report**
James G. Goree 31 Dec. 1975 121 p refs
(Grant NsG-1104)
(NASA-CR-145905) Avail: NTIS HC $5.50 CSCL 20K

Two solutions were developed for the two dimensional problem of bonded linearly elastic half-planes. For each solution, numerical results are presented for the stress intensity factors, strain energy release rate, stresses, and displacements. The behavior predicted by the studies was investigated experimentally using polymers for the material pairs. Close agreement was found for the critical stress intensity factor at fracture for the perpendicular crack near the interface. Fracture along the interface proved to be inconclusive due to difficulties in obtaining a brittle bond. Some interesting and predictable behavior regarding the potential for the crack to cross the interface was observed and is discussed.
Author

**N76-14513*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

**ESTIMATION OF Ksub Ic FROM SLOW BEND PRECRACKED CHARPY SPECIMEN STRENGTH RATIOS**

G. Succop and W. F. Brown, Jr. 1976 22 p refs Proposed for presentation at Developments and Fracture Mech. Test Method Standardization Symp., St. Louis, 10-12 Feb. 1976; sponsored by Am. Soc. for Testing and Materials

(NASA-TM-X-71834; E-8543) Avail: NTIS HC $3.50 CSCL 20K

Strength ratios are reported which were derived from slow bend tests on 0.25 inch thick precracked Charpy specimens of steels, aluminum alloys, and a titanium alloy for which valid K sub Ic values were established. The strength ratios were used to develop calibration curves typical of those that could be useful in estimating K sub Ic for the purposes of alloy development of quality control. Author

**N76-14514#** Aeronautical Research Labs., Melbourne (Australia).

**PROBABILISTIC DESIGN AND STRUCTURAL FATIGUE**

F. H. Hooke Nov. 1974 17 p refs

(ARL/SM-Rept-352) Avail: NTIS HC $3.50

Probabilistic design and its concern with situations of random loading actions imposed on structures of random strength are discussed. Requirements of the design theory include the impossibility of achieving absolute safety and an agreement concerning acceptable risk. Data are included on probability distribution of loads, virgin strength, and strength of decay rate. E.H.W.

**N76-14515#** National Research Council of Canada, Ottawa (Ontario).

**THE SHEAR STRENGTH OF SLENDER BEAMS WITH VERTICAL STIRRUPS, PART 1 AND 2**

B. Kuyt 1975 53 p refs Transl. into ENGLISH from Cement (Amsterdam), v. 24, no. 6, 1972 p 243-251 and v. 24, no. 9, 1972 p 346-353

(NRC/CNR-TT-1822-Pt-1/2) Avail: NTIS HC $4.50

The detailed static loading of slender prismatic beams (with constant height and width) with vertical stirrups was considered. In cases of combined loading (bending, shear, normal forces, torsion), it was assumed that a certain amount of play is available in assuming the slope of the compression diagonal. In the adopted truss analogy, this means that the concrete compression diagonals must find support in the vertical stirrups. Another aspect of detailing relates to the buildup of tensile forces in the main reinforcement bars. In addition to good end anchoring, attention should be paid to the value of the bond stresses, with a view specifically to preventing anchorage cracking above the points of support. The line of reasoning followed can also be applied to the determination of the ultimate strength with respect to girders subject to torsion (or torsion and bending combined). Author

**N76-14516#** National Aeronautical Lab., Bangalore (India). Instrumentation Div.

**AN AUTOMATIC CONTROL SYSTEM FOR RESONANCE TRACKING IN STRUCTURAL VIBRATION TESTING**

R. Viswanathan Jun. 1974 25 p refs

(NAL-TN-47) Avail: NTIS HC $3.50

An automatic control system, designed for use with multipoint excitation rigs, is described. The system uses phase-locked closed loop control to excite and track natural modes of vibration in complex structures. Six control loops are provided: one to control excitation frequency and the other five to control force levels. Details of design and performance of the system are presented. Author

**N76-14517*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

**EXPERIMENTAL PARAMETRIC STUDIES OF TRANSONIC T-TAIL FLUTTER**

Charles L. Ruhlin and Maynard C. Sandford Washington Dec. 1975 50 p refs

(NASA-TN-D-8066; L-10367) Avail: NTIS HC $4.00 CSCL 01C

Wind-tunnel tests of the T-tail of a wide-body jet airplane were made at Mach numbers up to 1.02. The model consisted of a 1/13-size scaled version of the T-tail, fuselage, and inboard wing of the airplane. Two interchangeable T-tails were tested, one with design stiffness for flutter-clearance studies and one with reduced stiffness for flutter-trend studies. Transonic antisymmetric-flutter boundaries were determined for the models with variations in: (1) fin-spar stiffness, (2) stabilizer dihedral angle (-5 deg and 0 deg), (3) wing and forward-fuselage shape, and (4) nose shape of the fin-stabilizer juncture. A transonic symmetric-flutter boundary and flutter trends were established for variations in stabilizer pitch stiffness. Photographs of the test configurations are shown. Author

**N76-14518*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

**DEVELOPMENT AND DEMONSTRATION OF A FLUTTER-SUPPRESSION SYSTEM USING ACTIVE CONTROLS**

Maynard C. Sandford, Irving Abel, and David L. Gray Washington Dec. 1975 67 p refs

(NASA-TR-R-450; L-10446) Avail: NTIS HC $4.50 CSCL 01A

The application of active control technology to suppress flutter was demonstrated successfully in the transonic dynamics tunnel with a delta-wing model. The model was a simplified version of a proposed supersonic transport wing design. An active flutter suppression method based on an aerodynamic energy criterion was verified by using three different control laws. The first two control laws utilized both leading-edge and trailing-edge active control surfaces, whereas the third control law required only a single trailing-edge active control surface. At a Mach number of 0.9 the experimental results demonstrated increases in the flutter dynamic pressure from 12.5 percent to 30 percent with active controls. Analytical methods were developed to predict both open-loop and closed-loop stability, and the results agreed reasonably well with the experimental results. Author

**N76-14519*#** Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.

**A CRACKED SHEET STIFFENED BY SEVERAL PARTIALLY DEBONDED INTACT OR BROKEN STRINGERS**

K. Arin Dec. 1975 29 p refs

(Grant NsG-1178)

(NASA-CR-145975) Avail: NTIS HC $4.00 CSCL 20K

The effect of several stringers on the stress intensity factors at the tips of a crack is considered. The stringers which were continuously attached to the plate and placed perpendicular to the crack may be partially debonded due to high stress concentrations. Since the stringers may even break under excessive loading conditions, both intact and broken stringers are considered to investigate the effect of rupture. The continuity of displacements along the bond lines leads to an integral equation which is solved to give the shear stress distribution in the adhesive and the stress intensity factors at the crack tips. Author

**N76-14520#** Army Engineer Waterways Experiment Station, Vicksburg, Miss. Soils and Pavements Lab.

**PAVEMENT RESPONSE TO AIRCRAFT DYNAMIC LOADS. VOLUME 1: INSTRUMENTATION SYSTEMS AND TESTING PROGRAM Final Report**

Walter J. Horn and Richard H. Ledbetter Jun. 1975 79 p refs

(Contract DOT-FA71WAI-218)

(AD-A016450/9; FAA-RD-74-39-Vol-1) Avail: NTIS HC $4.75 CSCL 13/2

A description is given of a study designed to determine the relationship between airport runway pavement responses to static and dynamic aircraft loads. Two series of tests were conducted, one during cold weather and the other during warm weather. Both a flexible and a rigid pavement runway were instrumented to measure and record pavement responses to aircraft loads. Aircraft were instrumented for both series to measure the aircraft wheel loads transmitted to the pavement structures during normal aircraft operations. A common time code signal recorded along with the pavement response and aircraft load data provided the means for correlating the two types of data. Data were collected for the following basic aircraft modes of operation: static loading, creep-, low-, medium-, and high speed taxi, high speed braking, takeoff rotation, touchdown, high speed braking with reverse thrust, and turning. Descriptions are given of the instrumentation systems and the program for testing. Author

**N76-14521*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**CYCLIC DEBONDING OF UNIDIRECTIONAL COMPOSITE BONDED TO ALUMINUM SHEET FOR CONSTANT-AMPLITUDE LOADING**
George L. Roderick, Richard A. Everett, Jr., and John H. Crews, Jr. Washington Jan. 1976 34 p refs
(NASA-TN-D-8126; L-10480) Avail: NTIS HC $4.00 CSCL 20K

Cyclic debonding rates were measured during constant-amplitude loading of specimens made of graphite/epoxy bonded to aluminum and S-glass/epoxy bonded to aluminum. Both room-temperature and elevated-temperature curing adhesives were used. Debonding was monitored with a photoelastic coating technique. The debonding rates were compared with three expressions for strain-energy release rate calculated in terms of the maximum stress, stress range, or a combination of the two. The debonding rates were influenced by both adherent thickness and the cyclic stress ratio. For a given value of maximum stress, lower stress ratios and thicker specimens produced faster debonding. Microscopic examination of the debonded surfaces showed different failure mechanisms both for identical adherends bonded with different adhesive and, indeed, even for different adherends bonded with identical adhesives. The expressions for strain-energy release rate correlated the data for different specimen thicknesses and stress ratios quite well for each material system, but the form of the best correlating expression varied among material systems. Empirical correlating expressions applicable to one material system may not be appropriate for another system. Author

**N76-14522*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**SHEAR-FLEXIBLE FINITE-ELEMENT MODELS OF LAMINATED COMPOSITE PLATES AND SHELLS**
Ahmed K. Noor (George Washington Univ.) and Michael D. Mathers (George Washington Univ.) Washington Dec. 1975 111 p refs
(NASA-TN-D-8044; L-10414) Avail: NTIS HC $5.50 CSCL 20K

Several finite-element models are applied to the linear static, stability, and vibration analysis of laminated composite plates and shells. The study is based on linear shallow-shell theory, with the effects of shear deformation, anisotropic material behavior, and bending-extensional coupling included. Both stiffness (displacement) and mixed finite-element models are considered. Discussion is focused on the effects of shear deformation and anisotropic material behavior on the accuracy and convergence of different finite-element models. Numerical studies are presented which show the effects of increasing the order of the approximating polynomials, adding internal degrees of freedom, and using derivatives of generalized displacements as nodal parameters. Author

**N76-14523#** Denver Univ., Colo. Dept. of Civil Engineering.
**UNIVERSITY-INDUSTRY WORKSHOP ON BEHAVIOR OF EXPANSIVE EARTH MATERIALS Final Report**
David A. Day, comp. and O. Don Richard, comp. Oct. 1974 103 p refs Workshop held at Denver, Colo., 17-19 Feb. 1974
(Grant NSF GK-40958)
(PB-242981/9) Avail: NTIS HC $5.50 CSCL 08M

The general objective of the workshop was to bring together approximately 30 engineers to jointly discuss the problems caused by expansive earth materials, the state-of-the-art of how to deal with them and to delineate research opportunities in this area which may lead to reductions in damage in the future. Among the areas discussed were: (1) pavements, (2) light buildings, (3) heavy buildings, and (4) other facilities (buried utilities, canals, dams, landslides, etc.) GRA

**N76-14524#** Naval Postgraduate School, Monterey, Calif.
**FACTORS AFFECTING THE FATIGUE STRENGTH OF FERRO-CEMENT M.S. Thesis**
David P. Sargent, Jr. Dec. 1974 89 p refs
(AD-A004254) Avail: NTIS CSCL 13/3

Ferro-cement is a composite material consisting of multiple layers of wire mesh impregnated with a cement mortar. Steel rods may be sandwiched in the center to give added strength, and to shape the mesh before application of the mortar. Selection of materials can vary considerably. Investigation of the influence of wire orientation on the fatigue strength of ferro-cement was undertaken in this study. Tests were also conducted to determine the effect on fatigue life of voids in the specimens caused by poor penetration of the mortar. GRA

**N76-14525#** Air Force Materials Lab., Wright-Patterson AFB, Ohio.
**STRESSES IN AN ADHESIVE BONDED COMPOSITE-TO-METAL ASSEMBLY**
Theodore J. Reinhard, Jr. and Weldon M. Scardino Jun. 1975 34 p refs
(AF Proj. 7381)
(AD-A013879; AFML-TR-75-14) Avail: NTIS CSCL 13/5

An in-house program was initiated in order to demonstrate the engineering feasibility of the use of boron/epoxy composites to add stiffness to metallic structural components. The program was designed to determine the level of the stresses induced in the boron epoxy (B/E) composite, the 321 stainless steel substrate and in the structural adhesive joining the two adherends. GRA

**N76-14526#** Naval Postgraduate School, Monterey, Calif.
**FUNDAMENTAL VIBRATIONAL FREQUENCY BY A 3D-FEM PROCEDURE M.S. Thesis**
Howard Lawrence Crego Jun. 1975 69 p refs
(AD-A013622) Avail: NTIS CSCL 20/11

This thesis presents a computer program which will solve for the lowest natural vibrational frequency of an arbitrarily shaped three dimensional object. The program was developed using a finite element numerical model which may employ either linear or quadratic isoparametric elements. Necessary instructions and guides for the user are included. GRA

**N76-14527#** Universal Technology Corp., Dayton, Ohio.
**MODAL ANALYSIS OF LINEAR NON-CONSERVATIVE SYSTEMS Technical Report, Jun. 1969 - Aug. 1972**
Richard L. Adkins May 1975 167 p refs
(Contracts F33615-71-C-1606; F33615-72-C-2113; AF Proj. 7351)
(AD-A013915; AFML-TR-75-2) Avail: NTIS CSCL 20/11

Modal methods for analyzing continuous, linear, nonconservative vibrating systems are developed and applied. Both viscous and hysteretic damping are considered and the damping distributions are arbitrary such that the normal modes of the corresponding undamped system will not uncouple the equations of motion of the nonconservative or damped system. Analytical and graphical results are presented for the special case of a pinned-pinned beam with a viscous or hysteretic damping unit at the center of the beam. These results show the uncoupled vibration modes, and the amplitude and phase variation along the beam for uniform harmonic forcing. The results of this investigation are contrasted to the modal methods for conservative systems and it is recommended that nonconservative systems be considered the general vibration problem. GRA

**N76-14291*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 5: NASTRAN**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 111-126 ref (For availability see N76-14286 05-31)
CSCL 20K

# 42 GEOSCIENCES (GENERAL)

**N76-14528*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**POSSIBLE RELATIONSHIPS BETWEEN SOLAR ACTIVITY AND METEOROLOGICAL PHENOMENA**
William R. Bandeen, ed. and Stephen P. Maran, ed. Washington 1975 263 p refs Symp. held at Greenbelt, Md., 7-8 Nov. 1973
(NASA-SP-366; LC-74-600165) Avail: NTIS MF $2.25; SOD

HC $4.00 CSCL 04B

A symposium was conducted in which the following questions were discussed: (1) the evidence concerning possible relationships between solar activity and meteorological phenomena; (2) plausible physical mechanisms to explain these relationships; and (3) kinds of critical measurements needed to determine the nature of solar/meteorological relationships and/or the mechanisms to explain them, and which of these measurements can be accomplished best from space. For individual titles, see N76-14529 through N76-14553.

**N76-14529*** University Corp. for Atmospheric Research, Boulder, Colo.

**RELATIONSHIPS BETWEEN SOLAR ACTIVITY AND CLIMATE CHANGE** **c47**

Walter Orr Roberts *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 13-24 refs (For availability see N76-14528 05-42)

CSCL 04B

The relationship between recurrent droughts in the High Plains of the United States and the double sunspot cycle is discussed in detail. It is suggested that high solar activity is generally related to an increase in meridional circulation and blocking patterns at high and intermediate latitudes, especially in winter, and the effect is related to the sudden formation of cirrus clouds during strong geomagnetic activity that originates in the solar corpuscular emission. Author

**N76-14530*** Stanford Univ., Calif.

**SOLAR ACTIVITY AND THE WEATHER** **c47**

John M. Wilcox *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 25-38 refs (For availability see N76-14528 05-42)

CSCL 04B

The attempts during the past century to establish a connection between solar activity and the weather are discussed; some critical remarks about the quality of much of the literature in this field are given. Several recent investigations are summarized. Use of the solar/interplanetary magnetic sector structure in future investigations is suggested to add an element of cohesiveness and interaction to these investigations. Author

**N76-14531*** Appleton Lab., Slough (England).

**MAGNETOMETEOROLOGY: RELATIONSHIPS BETWEEN THE WEATHER AND EARTH'S MAGNETIC FIELD** **c46**

J. W. King and D. M. Willis *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 39-41 refs (For availability see N76-14528 05-42)

CSCL 08N

A comparison of meteorological pressures and the strength of earth's magnetic field shows that the magnetic field exerts a controlling influence on the average pressure in the troposphere at high latitudes. The possibility of long-term changes in the geomagnetic field affecting the climate is discussed. M.J.S.

**N76-14532*** Australian Embassy, Washington, D.C.

**KIDSON'S RELATION BETWEEN SUNSPOT NUMBER AND THE MOVEMENT OF HIGH PRESSURE SYSTEMS IN AUSTRALIA** **c47**

E. G. Bowen *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 43-45 refs (For availability see N76-14528 05-42)

CSCL 04B

Kidson's relation is briefly described. It is concluded that if a relation is found between sunspots and weather, it is likely to appear in the march of high and low pressure systems around the poles. M.J.S.

**N76-14533*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**PROPOSED GEOMAGNETIC CONTROL OF SEMIANNUAL WAVES IN THE MESOSPHERIC ZONAL WIND** **c46**

A. D. Belmont (Control Data Corp.), G. D. Nastrom (Control Data Corp.), and Hans G. Mayr *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 47-52 refs Sponsored in part by DOT (For availability see N76-14528 05-42)

(Contract N00014-72-C-0308)

CSCL 04A

The polar semiannual oscillation in zonal wind explains midwinter weakening of the polar vortex and the relatively short stratospheric and mesospheric summer easterlies. The phase of the wind oscillation is equinoctial, as is the phase of the semiannual component in magnetic storm activity. For a given altitude, the contours of amplitude of the semiannual wind oscillation have less variability in geomagnetic than in geographic coordinates. It is suggested that the polar wind oscillations are caused by the semiannual maxima in magnetic storm activity, which lead to electron dissociation of O2 into O, in turn increasing ozone more rapidly than the dissociation of N2 destroys ozone, and inducing a semiannual variation in the thermal and wind fields. This implies that geomagnetic processes may cause or affect the development of sudden warmings. As the tropical semiannual wind oscillation is symmetric about the geomagnetic equator, the same processes may also influence the location of the tropical wind wave. Author

**N76-14534*** Academy of Sciences (USSR), Moscow.

**CERTAIN REGULARITIES OF GEOMAGNETIC AND BARIC FIELDS AT HIGH LATITUDES** **c46**

S. M. Mansurov, G. S. Mansurov, and L. G. Mansurova *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 53-58 refs (For availability see N76-14528 05-42)

CSCL 04A

The existence of a relation between the variations of magnetic field at earth's surface in near-pole regions and the sector structure of the interplanetary magnetic field is considered as the evidence of the influence of the solar wind with its magnetic field on the processes proceeding in the magnetosphere. Two peculiarities between geomagnetic and interplanetary fields are discussed in detail: the north-south and spring-autumn asymmetry. M.J.S.

**N76-14535*** Colorado State Univ., Fort Collins.

**ON POSSIBLE INTERACTIONS BETWEEN UPPER AND LOWER ATMOSPHERE** **c46**

Bruce C. MacDonald and Elmar R. Reiter *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 59-69 refs Sponsored by ERDA (For availability see N76-14528 05-42)

CSCL 04A

Geomagnetic data was compared with data on tropospheric and stratospheric circulation characteristics; a statistically significant shrinking was found in areal extent of the stratospheric vortex from the third to the eighth day following a 'geomagnetic storm' The meridionality of the 30 640-m contour line at 10 millibars increases markedly from 5 to 8 days after the storm. During the contraction of the polar vortex edge, the mean height of the vortex central contour decreases only slightly. This indicates that a stratospheric warming event is associated with a steepening of the contour gradient rather than a warming over the entire area of the stratospheric polar vortex. The troposphere reacts to these weak, but significant, stratospheric warming events by a shrinkage of the area of the 500-millibar cold air pool. This shrinkage commences about 3 days after the stratospheric warming. The investigation indicates that the energy input into the stratosphere that is received in conjunction with the geomagnetic disturbance has to come at a propitious time, when the stratospheric-tropospheric circulation system is not already undergoing a major readjustment because of an inherent dynamic instability. Author

**N76-14536*** Northrop Services, Inc., Houston, Tex.

**A SPECTRAL SOLAR/CLIMATIC MODEL** **c47**

H. Prescott Sleeper, Jr. *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 71-78 refs (For availability see N76-14528 05-42)

(Contract NAS8-21810)

CSCL 04B

A summary is presented of pertinent research on solar activity variations and climate variations, together with the presentation of an empirical solar/climatic model that attempts to clarify the nature of the relationships. Author

**N76-14537*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A POSSIBLE CORRELATION BETWEEN MAXIMA OF THE FAR ULTRAVIOLET SOLAR IRRADIANCE AND CENTRAL MERIDIAN PASSAGES OF SOLAR MAGNETIC SECTOR BOUNDARIES** **c47**
Donald F. Heath and John M. Wilcox (Stanford Univ.) *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 79-81 refs (For availability see N76-14528 05-42)
CSCL 04B

Satellite observations of the sun over almost 5 yrs show that principally two UV active longitudes have persisted over a significant portion of this observational period. A comparison between the position of solar magnetic sector boundaries and UV enhancements of the sun seems to show, at least during the year 1969, that the UV maxima tend to occur near the times when a solar sector boundary is near central meridian. An estimate of the magnitude of the variable UV solar energy input into the atmosphere resulting from the rotation of active solar longitudes is that for wavelengths less than 175 nm and down to H Lyman-alpha it exceeds the annual variation, whereas at longer wavelengths it is less. Author

**N76-14538*** Aerospace Corp., El Segundo, Calif.
**THE AURORA AS A SOURCE OF PLANETARY-SCALE WAVES IN THE MIDDLE ATMOSPHERE** **c46**
Y. T. Chiu and J. M. Straus *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 83-87 refs (For availability see N76-14528 05-42)
(Contract F04701-73-C-0074)
CSCL 04A

Photographs of global-scale auroral forms taken by scanning radiometers onboard U.S. Air Force weather satellites in 1972 show that auroral bands exhibit well-organized wave motion with typical zonal wave number of 5 or so. The scale size of these waves is in agreement with that of well-organized neutral wind fields measured by the 1967-50B satellite in the 150- to 220-km region during the geomagnetic storm of May 27, 1967. The horizontal scale size revealed by these observations is in agreement with that of high-altitude traveling ionospheric disturbances. It is conjectured that the geomagnetic storm is a source of planetary and synoptic scale neutral atmospheric waves in the middle atmosphere. The possible existence of a source of waves of the proper scale size to trigger instabilities in middle atmospheric circulation systems may be significant in the study of lower atmospheric response to geomagnetic activity. Author

**N76-14539*** Lockheed Missiles and Space Co., Palo Alto, Calif.
**DIRECT SATELLITE OBSERVATIONS ON BREMSSTRAHLUNG RADIATION AS A TECHNIQUE TO INVESTIGATE ITS ROLE IN METEOROLOGICAL PROCESSES** **c47**
R. G. Johnson and W. L. Imhof *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 89-94 refs Sponsored by ONR (For availability see N76-14528 05-42)
CSCL 04B

It was suggested that bremsstrahlung radiation associated with strong auroras (in turn associated with geomagnetic disturbances) may cause increased ionization near the 300-millibar level, which, in turn, leads to the formation of cirrus clouds. These clouds could modify the outgoing black body radiation rates and influence weather patterns. The first satellite observations on bremsstrahlung radiation produced in the atmosphere by precipitating energetic electrons are discussed. This type of observation affords the possibility of directly monitoring the bremsstrahlung energy input to the lower atmosphere over large segments of earth and at frequent intervals. Detailed measurements on the spatial and energy distributions of the bremsstrahlung radiation are feasible with present techniques, and satellite data on widespread bremsstrahlung events are presented and discussed. From comparison of the ion production rates from cosmic rays with those calculated from bremsstrahlung from precipitating energetic electrons, it is concluded that bremsstrahlung radiation is a negligible contributor to the ionization near the 300-millibar level. Author

**N76-14540*** Maryland Univ., College Park.
**SOLAR FLUX AND ITS VARIATIONS** **c92**
Elske V. P. Smith and David M. Gottlieb *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 97-117 refs (For availability see N76-14528 05-42)
(Grant NGL-21-002-033)
CSCL 03B

Data are presented on the solar irradiance as derived from a number of sources. An attempt was made to bring these data onto a uniform scale. Summation of fluxes at all wavelengths yields a figure of 1357.826 for the solar constant. Estimates are made of the solar flux variations due to flares, active regions (slowly varying component), 27-day period, and the 11-yr cycle. Solar activity does not produce a significant variation in the value of the solar constant. Variations in the X-ray and EUV portions of the solar flux may be several orders of magnitude during solar activity, especially at times of major flares. It is established that these short wavelength flux enhancements cause significant changes in the terrestrial ionosphere. Author

**N76-14541*** Stanford Univ., Calif.
**GEOMAGNETIC RESPONSES TO THE SOLAR WIND AND THE SOLAR ACTIVITY** **c46**
Leif Svalgaard *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 119-142 refs (For availability see N76-14528 05-42)
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138)
CSCL 04N

Following some historical notes, the formation of the magnetosphere and the magnetospheric tail is discussed. The importance of electric fields is stressed and the magnetospheric convection of plasma and magnetic field lines under the influence of large-scale magnetospheric electric fields is outlined. Ionospheric electric fields and currents are intimately related to electric fields and currents in the magnetosphere and the strong coupling between the two regions is discussed. The energy input of the solar wind to the magnetosphere and upper atmosphere is discussed in terms of the reconnection model where interplanetary magnetic field lines merge or connect with the terrestrial field on the sunward side of the magnetosphere. The merged field lines are then stretched behind earth to form the magnetotail so that kinetic energy from the solar wind is converted into magnetic energy in the field lines in the tail. Localized collapses of the crosstail current, which is driven by the large-scale dawn/dusk electric field in the magnetosphere, divert part of this current along geomagnetic field lines to the ionosphere, causing substorms with auroral activity and magnetic disturbances. The collapses also inject plasma into the radiation belts and build up a ring current. Frequent collapses in rapid succession constitute the geomagnetic storm. Author

**N76-14542*** Harvard Coll. Observatory, Cambridge, Mass.
**SOLAR MODELS IN RELATION TO TERRESTRIAL CLIMATIC VARIATIONS** **c47**
A. G. W. Cameron *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 143-147 refs (For availability see N76-14528 05-42)
CSCL 04B

The possibility is discussed of occasional larger changes in the state of the sun, lasting for some millions of years, which might be responsible for producing more drastic changes in earth's climate, called ice ages. Author

**N76-14543*** National Aeronautics and Space Administration. Goddard Space Flight Center, Albuquerque, N. Mex.
**POSSIBLE RELATIONSHIPS BETWEEN SOLAR ACTIVITY AND ATMOSPHERIC CONSTITUENTS** **c46**
Robert G. Roosen and Ronald J. Angione (San Diego State Univ.) *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 149-154 refs (For availability see N76-14528 05-42)
CSCL 04A

The large body of data on solar variations and atmospheric constituents collected between 1902 and 1953 by the Astrophysical Observatory of the Smithsonian Institution (APO) was

examined. Short-term variations in amounts of atmospheric aerosols and water vapor due to seasonal changes, volcanic activity, air pollution, and frontal activity are discussed. Preliminary evidence indicates that increased solar activity is at times associated with a decrease in attenuation due to airborne particulates. Author

**N76-14544*** National Oceanic and Atmospheric Administration, Washington, D.C.
**FUTURE MONITORING OF CHARGED PARTICLE ENERGY DEPOSITION INTO THE UPPER ATMOSPHERE AND COMMENTS ON POSSIBLE RELATIONSHIPS BETWEEN ATMOSPHERIC PHENOMENA AND SOLAR AND/OR GEOMAGNETIC ACTIVITY** **c46**
D. J. Williams, R. N. Grubb, D. S. Evans, and H. H. Sauer *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 155-159 refs (For availability see N76-14528 05-42)
CSCL 08N

Monitoring of earth's atmosphere was conducted for several years utilizing the ITOS series of low-altitude, polar-orbiting weather satellites. A space environment monitoring package was included in these satellites to perform measurements of a portion of earth's charged particle environment. The charged particle observations proposed for the low-altitude weather satellite TIROS N, are described which will provide the capability of routine monitoring of the instantaneous total energy deposition into the upper atmosphere by the precipitation of charged particles from higher altitudes. Such observations may be of use in future studies of the relationships between geomagnetic activity and atmospheric weather pattern developments. Estimates are given to assess the potential importance of this type of energy deposition. Discussion and examples are presented illustrating the importance of distinguishing between solar and geomagnetic activity as possible causative sources. Such differentiation is necessary because of the widely different spatial and time scales involved in the atmospheric energy input resulting from these various sources of activity. Author

**N76-14545*** Polytechnic Inst. of New York.
**APPARENT RELATIONSHIP BETWEEN SOLAR SECTOR BOUNDARIES AND 300-MILLIBAR VORTICITY: POSSIBLE EXPLANATION IN TERMS OF UPWARD PROPAGATION OF PLANETARY-SCALE WAVES** **c93**
Raymond J. Deland *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 163-165 (For availability see N76-14528 05-42)
CSCL 03B

The correlations between the solar sectors and large-scale atmospheric vorticity in the lower atmosphere reported earlier are of interest since the solar-sector data appear to be independent of any terrestrial influences. It is shown that even these solar data may be affected by geomagnetic properties; a method for removing such influences is suggested. Author

**N76-14546*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**HIGH-LATITUDE IONOSPHERIC WINDS RELATED TO SOLAR-INTERPLANETARY CONDITIONS** **c46**
J. P. Heppner *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 167-170 refs (For availability see N76-14528 05-42)
CSCL 04A

Treated jointly, two recent results imply that the distribution of winds in the polar ionosphere should change as a function of the direction of the interplanetary magnetic field. From the motions of chemically released ion and neutral clouds, it is apparent that neutral winds in the high-latitude ionosphere are driven principally by ion drag forces. OGO 6 electric field measurements demonstrate that there are definite relationships between the time/latitude distribution of ionospheric plasma convection and interplanetary magnetic field parameters, and also that the distribution is most sensitive to the azimuthal angle of the inter planetary field. Although direct neutral wind to interplanetary magnetic field comparisons are not available, logic clearly implies a close relationship. Observations of infrasonic waves following sudden ionization enhancements indicate the existence of momentum transfer. Author

**N76-14547*** State Univ. of New York, Stony Brook.
**SOLAR MODULATION OF ATMOSPHERIC ELECTRIFICATION THROUGH VARIATION OF THE CONDUCTIVITY OVER THUNDERSTORMS** **c47**
Ralph Markson *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 171-178 refs (For availability see N76-14528 05-42)
CSCL 04B

It is suggested that variations of the current in the global atmospheric electrical circuit can be produced through regulation of the resistance between the tops of thunderclouds and the ionosphere. Long- and short-term changes in the conductivity of this region occur due to changes in the ionization rate resulting from solar activity. Previous suggestions that the phenomena might be due to conductivity variations in the fair weather part of the world or an influx of space charge to the upper atmosphere are discussed and considered unlikely. It might be possible to test the proposed mechanism by measuring the temporal variation of the ionospheric potential during distributed solar periods. Another approach would be to measure simultaneously the variation in ionization rate and electric current over thunderstorms. Several ways in which changes in atmospheric electrification might influence other meteorological phenomena are mentioned. Author

**N76-14548*** Cornell Univ., Ithaca, N.Y.
**SOLAR LUMINOSITY VARIATIONS AND THE CLIMATE OF MARS** **c91**
Owen B. Toon, Peter J. Gierasch, and Carl Sagan *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 179-184 refs (For availability see N76-14528 05-42)
(Grant NGR-33-010-220)
CSCL 03B

A simple climatological model of Mars indicates that its climate may be more sensitive to luminosity changes than earth's because of strong positive feedback mechanisms at work on Mars. Mariner 9 photographs of Mars show an abundance of large sinuous channels that point to an epoch of higher atmospheric pressures and abundant liquid water. Such an epoch could have been the result of large-scale solar luminosity variations. The climatological model suggests that other less controversial mechanisms, such as obliquity or polar albedo changes, also could have led to such an epoch. Author

**N76-14549*** Rice Univ., Houston, Tex.
**SOME PROBLEMS IN COUPLING SOLAR ACTIVITY TO METEOROLOGICAL PHENOMENA** **c47**
A. J. Dessler *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 187-197 refs (For availability see N76-14528 05-42)
(Grant NGL-44-006-012)
CSCL 04B

The development of a theory of coupling of solar activity to meteorological phenomena is hindered by the difficulties of devising a mechanism that can modify the behavior of the troposphere while employing only a negligible amount of energy compared with the energy necessary to drive the normal meteorological system, and determining how such a mechanism can effectively couple some relevant magnetospheric process into the troposphere in such a way as to influence the weather. A clue to the nature of the interaction between the weather and solar activity might be provided by the fact that most solar activity undergoes a definite 11-yr cycle, and meteorological phenomena undergo either no closely correlated variation, an 11-yr variation, or a 22-yr variation. Author

**N76-14550*** National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
**NUMERICAL EXPERIMENTS ON SHORT-TERM METEOROLOGICAL EFFECTS ON SOLAR VARIABILITY** **c47**
R. C. J. Somerville, J. E. Hansen, P. H. Stone, W. J. Quirk, and A. A. Lacis (Computer Sciences Corp.) *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 199-211 refs (For availability see N76-14528 05-42)
CSCL 04B

A set of numerical experiments was conducted to test the short-range sensitivity of a large atmospheric general circulation model to changes in solar constant and ozone amount. On the basis of the results of 12-day sets of integrations with very large variations in these parameters, it is concluded that realistic variations would produce insignificant meteorological effects. Any causal relationships between solar variability and weather, for time scales of two weeks or less, rely upon changes in parameters other than solar constant or ozone amounts, or upon mechanisms not yet incorporated in the model. Author

**N76-14551*** Alaska Univ., Fairbanks. Geophysical Inst.
**AURORAL EFFECTS IN THE D REGION OF THE IONOSPHERE** **c46**
Syun-Ichi Akasofu *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 213-223 refs (For availability see N76-14528 05-42)
CSCL 03A

The possible effects are discussed of radiations and corpuscles on relatively short-term changes in the circulation of the atmosphere (the development of cellular patterns in the zonal westerly flow, leading to the formation of cyclones) and relatively long-term changes in climate. Author

**N76-14552*** Toronto Univ. (Ontario).
**TWO POSSIBLE MECHANISMS FOR RELATING TERRESTRIAL ATMOSPHERIC CIRCULATION TO SOLAR DISTURBANCES** **c46**
C. O. Hines *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 225-226 refs (For availability see N76-14528 05-42)
CSCL 03A

During geomagnetic storms, which are initiated by solar disturbances, two cells of circulatory motion are established in the polar ionosphere. The torques that contribute to either cell might be as great as 10 to the 24 power dyne cm, and may persist for times of the order 100,000 sec. The angular momentum contributed to a cell may be as great as 10 to the 29th power g sq cm/sec. Angular momentum is discussed. Author

**N76-14553*** National Center for Atmospheric Research, Boulder, Colo.
**CORRELATIONS AND LINKAGES BETWEEN THE SUN AND THE EARTH'S ATMOSPHERE: NEEDED MEASUREMENTS AND OBSERVATIONS** **c46**
William W. Kellogg *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 227-237 refs (For availability see N76-14528 05-42)
CSCL 04A

A study was conducted to identify the sequence of processes that lead from some change in solar input to the earth to a change in tropospheric circulation and weather. Topics discussed include: inputs from the sun, the solar wind, and the magnetosphere; bremsstrahlung, ionizing radiation, cirrus clouds, thunderstorms, wave propagation, and gravity waves. M.J.S.

**N76-14554#** Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
**DETERMINATION OF THE DIRECTION OF THE MINOR AXIS OF THE REFERENCE ELLIPSOID AND THE PLANE OF THE INITIAL GEODETIC MERIDIAN FROM OBSERVATIONS OF ARTIFICIAL EARTH SATELLITES**
M. Bursa 1975 15 p refs Transl. into ENGLISH from Studia Geophys. Geodaet. Ceskoslov. Akad. Ved (Prague), v. 9, no. 1, 1965 p 14-22
(NRC/CNR-TT-1830) Avail: NTIS HC $3.50

The problem of determining the directions of the basis axes of the geodetic reference system with respect to the astronomical system (X, Y, Z), directionally defined by the direction of the earth's axis of rotation and the plane of the initial astronomical (Greenwich) meridian, is solved. The problem is theoretically based on the transformation relations between the direction cosines of the line M sub i M sub k, joining two astrogeodetic points, in both coordinate systems. It is shown how the results of simultaneous observations of satellites can be used for azimuth control of astrogeodetic networks, and also for determining respective corrections of geodetic coordinates and quasigeoidal heights. Author

**N76-14555*#** Kanner (Leo) Associates, Redwood City, Calif.
**IMPORTANCE OF SOIL MICROFLORA IN THE BIOGENETIC MIGRATION OF BORON IN BIOGEOCHEMICAL PROVINCES CONTAINING DIFFERENT AMOUNTS OF BORON**
V. V. Kovalskiy Washington NASA Oct. 1974 10 p refs Transl. into ENGLISH from Agrokhimiya (USSR), no. 6, 1973 p 84-88
(Contract NASw-2481)
(NASA-TT-F-15980) Avail: NTIS HC $3.50 CSCL 06M

Soils of biogeochemical provinces, high in B, contained 0.005-0.40% B and 0.005-0.048% microbial biomass (on air-dry basis). The biomass of soil microflora and the amount of B involved by it in biogenetic migration showed seasonal changes. In biogeochemical provinces high in B, 2.7-77.0-fold more B was bound by soil microflora than in provinces with B-deficient soils. Depending on B level of soils 0.018-0.125% of the total B content of soils was bound by soil microflora. All the B contained in the soil might pass through the living tissues of soil microorganisms in the course of a few hours if their propagation were unimpeded. Author

**N76-14556#** Kansas Water Resources Research Inst., Manhattan.
**PREDICTING EVAPOTRANSPIRATION FROM AGRICULTURAL WATER SHEDS UNDER DRY CONDITIONS Project Completion Report, 1 Jun. 1973 - 31 Aug. 1974**
Jerome J. Zovne and Ahmad Nawaz May 1975 72 p refs
(Contract DI-14-31-0001-3516)
(PB-243562/6; Contrib-164; W75-09860;
OWRT-A-050-KAN(1)) Avail: NTIS HC $4.50 CSCL 02C

An evapotranspiration (ET) function for the Kansas Water Budget model is developed and tested. The purpose of the ET function is to improve the response of Kansas model to daily climatic changes and to the distribution and stage of growth of crops on an agricultural watershed. The function uses the Penman Combination equation modified by three coefficients which account for (1) the soil moisture availability, (2) the incrased soil surface evaporation following rainfall, and (3) for the crop transpiration efficiency which varies with the crop and the stage of growth. The function was programmed into the present Kansas model and applied to the Black Vermillion water sheds. GRA

# 43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

**N76-14557** Washington Univ., Seattle.
**INTEGRATION OF REMOTE SENSING AND PHOTOGRAMMETRY: A UNIFIED DIGITAL APPROACH TO INTERPRETATION AND MAPPING OF MULTISPECTRAL AERIAL PHOTOGRAPHY Ph.D. Thesis**
Hans Jakob Bernath 1974 154 p
Avail: Univ. Microfilms Order No. 75-28318

Remote sensing is conceived as a mapping of a multidimensional object space onto another vector space of the same or fewer dimensions. It is a general transformation of the geometric and radiometric variables. Hence image interpretation or specifically photointerpretation is the inverse of this imaging function. A comprehensive mathematical model is formulated to describe the remote sensing data acquisition and interpretation problem. The behavior of the numerous parameters involved is quantified and relationships are established. The capability of the total digital concept is demonstrated by an example of automated land use mapping of a suburban environment. The theoretical limits of the automated approach are investigated and visually displayed by a set of computer maps. Dissert. Abstr.

**N76-14558*#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**DESIGN DATA COLLECTION WITH SKYLAB MICROWAVE**

**RADIOMETER-SCATTEROMETER S-193, VOLUME 2 Final Report, 26 Mar. 1973 - 31 Dec. 1975**
Richard K. Moore and Fawwaz T. Ulaby, Principal Investigators Aug. 1975 119 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13331)
(E76-10075; NASA-CR-144538; RSL-TR-243-12-Vol-2) Avail: NTIS HC $5.50 CSCL 08B

The author has identified the following significant results. Skylab S-193 radiometer/scatterometer produced terrain responses with various polarizations and observation angles for cells of 100 to 400 sq km area. Classification of the observations into natural categories was achieved by K-means and spatial clustering algorithms. Microwave data acquired over the Great Salt Lake Desert area by sensors aboard Skylab and Nimbus 5 indicate that the microwave emission and backscatter were strongly influenced by contributions from subsurface layers of sediment saturated with brine. Correlations were noted between microwave backscatter response at approximately 33 deg from scatterometer (operating at 13.9 GHz) and the configuration of ground targets in Brazil as discerned from coarse scale maps. With limited, available ground truth, these correlations were sufficient to permit the production of image-like displays which bear a marked resemblance to known terrain features in several instances.

**N76-14559*#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**DESIGN DATA COLLECTION WITH SKYLAB MICROWAVE RADIOMETER-SCATTEROMETER S-193, VOLUME 1 Final Report**
Richard K. Moore and Fawwaz T. Ulaby, Principal Investigators Sep. 1975 682 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13331)
(E76-10076; NASA-CR-144537; RSL-TR-243-12-Vol-1) Avail: NTIS HC $16.25 CSCL 08B

The author has identified the following significant results. Observations with S-193 have provided radar design information for systems to be flown on spacecraft, but only at 13.9 GHz and for land areas over the United States and Brazil plus a few other areas of the world for which this kind of analysis was not made. Observations only extended out to about 50 deg angle of incidence. The value of a sensor with such a gross resolution for most overland resource and status monitoring systems seems marginal, with the possible exception of monitoring soil moisture and major vegetation variations. The complementary nature of the scatterometer and radiometer systems was demonstrated by the correlation analysis. Although radiometers must have spatial resolutions dictated by antenna size, radars can use synthetic aperture techniques to achieve much finer resolutions. Multiplicity of modes in the S-193 sensors complicated both the system development and its employment. An attempt was made in the design of the S-193 to arrange optimum integration times for each angle and type of measurement. This unnecessarily complicated the design of the instrument, since the gains in precision achieved in this way were marginal. Either a software-controllable integration time or a set of only two or three integration times would have been better.

**N76-14560*#** Milan Univ. (Italy).
**GEOMORPHIC AND LANDFORM SURVEY OF NORTHERN APPENNINI Quarterly Report**
Carlo M. Marino, Principal Investigator 31 Oct. 1975 4 p Sponsored by NASA ERTS
(E76-10077; NASA-CR-145806; QR-1) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

**N76-14561*#** Inter-American Geodetic Survey, Fort Clayton (Canal Zone).
**OVERALL EVALUATION OF SKYLAB IMAGERY FOR MAPPING OF LATIN AMERICA Final Report, Aug. 1972 - Sep. 1975**
Jack E. Staples, Jorge Jose Maria Eoldan (Inst. Geografico Militar, Argentina), Oscar Wilde Fernandez (Inst. Geografico Militar, Bolivia), Miguel Alves (Inst. Brasileiro de Geografia e Estatistica, Peru), Jose Mutis (Inst. Geografico Militar, Chile), Alvaro Gonzalez Fletcher (Inst. Geografico Agustin Codazzi, Columbia), Mario Barrantes Ferrero (Inst. Geografico Nacional de Costa Rica), Jose Joaquin Hungria Morell (Inst. Geografico Univ., Republica Dominicana), Leonardo Endara Romero (Inst. Geografico Militar, Ecuador), Jose Alberto Gonzalez Garcia, Principal Investigators (Inst. Geografico Nacional, El Salvador) et al Sep. 1975 101 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4651-B)
(E76-10078; NASA-CR-144476) Avail: NTIS HC $5.50 CSCL 08B

The author has identified the following significant results. Skylab imagery is both desired and needed by the Latin American catographic agencies. The imagery is cost beneficial for the production of new mapping and maintenance of existing maps at national topographic series scales. If this information was available on a near time routine coverage basis, it would provide an excellent additional data base to the Latin American cartographic community, specifically Argentina, Bolivia, Chile, Colombia, Dominican Republic, Guatemala, Paraguay, and Venezuela.

**N76-14562*#** Agricultural Research Service, Weslaco, Tex.
**A STUDY OF THE EARLY DETECTION OF INSECT INFESTATIONS AND DENSITY/DISTRIBUTION OF HOST PLANTS Final Report**
William G. Hart, Principal Investigator, Sammy J. Ingle, and M. R. Davis [1975] 30 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(NASA Order T-4109-B)
(E76-10079; NASA-CR-144483) Avail: NTIS HC $4.00 CSCL 02C

The author has identified the following significant results. With comparative observations of film types and seasonal influences on reflectance characteristics, many crop varieties can be identified. This study shows that citrus, sugar cane, brush, some winter vegetables, and grain crops could be identified. Vegetative patterns in border areas can be detected. This information can be useful in detecting avenues of entry of pest species and areas of stress that require vigilance in stopping the spread of destructive species. Influence of some environmental factors on crops that may be confused with pest injury, or related factors, can be detected and identified with Skylab data (S-190B).

**N76-14563*#** Mississippi Test Facility, Bay St. Louis.
**APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Progress Report, 1 Sep. - 15 Nov. 1975**
Kenneth J. Savastano, Principal Investigator 25 Nov. 1975 3 p EREP
(NASA Order T-8217-B)
(E76-10080; NASA-CR-145885; PR-20) Avail: NTIS HC $3.50 CSCL 08A

There are no author-identified significant results in this report.

**N76-14564*#** Calspan Corp., Buffalo, N.Y.
**S190 INTERPRETATION TECHNIQUES DEVELOPMENT AND APPLICATION TO NEW YORK STATE WATER RESOURCES Final Report**
Kenneth R. Piech, Principal Investigator, John R. Schott, and Kenton M. Stewart (States Univ. of N. Y., Buffalo) Jun. 1975 50 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13336)
(E76-10081; NASA-CR-144499; YB-5298-M-2) Avail: NTIS HC $4.00 CSCL 08H

The author has identified the following significant results. The program has demonstrated that Skylab imagery can be utilized to regularly monitor eutrophication indices of lakes, such as

chlorophyll concentration and photic zone depth. The relationship between the blue to green reflectance ratio and chlorophyll concentration was shown, along with changes in lake properties caused by chlorophyll, lignin, and humic acid using reflectance ratios and changes. A data processing technique was developed for detecting atmospheric fluctuations occurring over a large lake.

**N76-14565*#** Army Construction Engineering Research Lab., Champaign, Ill.
**EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIR ON THE ENVIRONMENT AND ECOLOGY Progress Report, 1 Jul. - 30 Sep. 1975**
R. K. Jain, Principal Investigator 10 Oct. 1975 2 p Sponsored by NASA ERTS
(E76-10082; NASA-CR-145869) Avail: NTIS HC $3.50 CSCL 13B

There are no author-identified significant results in this report.

**N76-14566*#** Norsk Polarinstitutt, Oslo.
**SEA ICE STUDIES IN THE SPITSBERGEN-GREENLAND AREA Quarterly Report**
Torgny E. Vinje, Principal Investigator 11 Nov. 1975 3 p Sponsored by NASA and Roy. Norwegian Council for Sci. and Indust. Res. ERTS
(E76-10083; NASA-CR-145870; QR-1) Avail: NTIS HC $3.50 CSCL 08L

There are no author-identified significant results in this report.

**N76-14567*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
**AN INTERDISCIPLINARY ANALYSIS OF COLORADO ROCKY MOUNTAIN ENVIRONMENTS USING ADP TECHNIQUES Final Report, 1 Jul. 1972 - 30 Apr. 1974**
Roger M. Hoffer, Principal Investigator 15 Sep. 1974 124 p refs Prepared in cooperation with Colorado Univ., Boulder Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21880)
(E76-10084; NASA-CR-145871; Bull-919; LARS-Inform-Note-061575) Avail: NTIS HC $5.50 CSCL 08B

The author has identified the following significant results. Good ecological, classification accuracy (90-95%) can be achieved in areas of rugged relief on a regional basis for Level 1 cover types (coniferous forest, deciduous forest, grassland, cropland, bare rock and soil, and water) using computer-aided analysis techniques on ERTS/MSS data. Cost comparisons showed that a Level 1 cover type map and a table of areal estimates could be obtained for the 443,000 hectare San Juan Mt. test site for less than 0.1 cent per acre, whereas photointerpretation techniques would cost more than 0.4 cent per acre. Results of snow cover mapping have conclusively proven that the areal extent of snow in mountainous terrain can be rapidly and economically mapped by using ERTS/MSS data and computer-aided analysis techniques. A distinct relationship between elevation and time of freeze or thaw was observed, during mountain lake mapping. Basic lithologic units such as igneous, sedimentary, and unconsolidated rock materials were successfully identified. Geomorphic form, which is exhibited through spatial and textual data, can only be inferred from ERTS data. Data collection platform systems can be utilized to produce satisfactory data from extremely inaccessible locations that encounter very adverse weather conditions, as indicated by results obtained from a DCP located at 3,536 meters elevation that encountered minimum temperatures of -25.5 C and wind speeds of up to 40.9m/sec (91 mph), but which still performed very reliably.

**N76-14568*#** Cornell Univ., Ithaca, N.Y. Resource Information Lab.
**ENHANCEMENT AND EVALUATION OF SKYLAB PHOTOGRAPHY FOR POTENTIAL LAND USE INVENTORIES, PART 1 Final Report, 1 May 1973 - 31 Jul. 1975**
E. E. Hardy, Principal Investigator, J. E Skaley, C. P. Dawson, G. D. Weiner, E. S. Phillips, and R. A. Fisher Jul. 1975 216 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-13364)
(E76-10085; NASA-CR-144473) Avail: NTIS HC $7.75 CSCL 08B

The author has identified the following significant results. Three sites were evaluated for land use inventory: Finger Lakes - Tompkins County, Lower Hudson Valley - Newburgh, and Suffolk County - Long Island. Special photo enhancement processes were developed to standardize the density range and contrast among S190A negatives. Enhanced black and white enlargements were converted to color by contact printing onto diazo film. A color prediction model related the density values on each spectral band for each category of land use to the spectral properties of the various diazo dyes. The S190A multispectral system proved to be almost as effective as the S190B high resolution camera for inventorying land use. Aggregate error for Level 1 averaged about 12% while Level 2 aggregate error averaged about 25%. The S190A system proved to be much superior to LANDSAT in inventorying land use, primarily because of increased resolution.

**N76-14569*#** Minnesota Univ., Minneapolis. Space Science Center.
**A STUDY OF MINNESOTA FORESTS AND LAKES USING DATA FROM EARTH RESOURCES TECHNOLOGY SATELLITES Progress Report**
30 Jun. 1975 75 p refs Original contains color illustrations
(Grant NGL-24-005-263)
(NASA-CR-145904) Avail: NTIS HC $4.50 CSCL 08B

ERTS and Landsat images were used to study water quality and turbidity around St. Paul-Minneapolis metropolitan area. Sediments were also investigated in the same area. In northeastern Minnesota north of Lake Superior, the intercontinental rift was examined, along with large, low grade, copper-nickel deposits. For individual titles, see N76-14570 through N76-14573.

**N76-14570*** Minnesota Univ., Minneapolis. Dept. of Geography.
**REMOTE SENSING APPLICATIONS TO HYDROLOGY IN MINNESOTA**
Dwight Brown and Richard Skaggs *In its* A Study of Minn. Forests and Lakes using Data from Earth Resources Technol. Satellites 30 Jun. 1975 66 p refs (For availability see N76-14569 05-43)
CSCL 08H

Development of low lying southeastern shore of Pike Lake is described as part of the Rice Creek watershed study. Several small wetlands in Arden Hills, Minnesota were incorporated into the drainage plans as pollutant and nutrient sinks rather than being infilled. Lake water quality in the St. Paul-Minneapolis metropolitan area was analyzed using Landsat images. In the same urban area, the inventory and seasonal change of the open water were also studied. J.A.M.

**N76-14571*** Minnesota Univ., Duluth. Dept. of Physics.
**TURBIDITY IN EXTREME WESTERN LAKE SUPERIOR**
Michael Sydor *In its* A Study of Minn. Forests and Lakes using Data from Earth Resources Technol. Satellites 30 Jun. 1975 25 p refs (For availability see N76-14569 05-43)
CSCL 08H

Data were obtained from ERTS images for western Lake Superior for 1972-74. Data examination showed that for easterly winds the turbidity originating along the Wisconsin shore and the resuspension areas are transported northward then out along a N.E. path where it disperses, and often, for large storms, contaminates the Duluth water intake. Contaminants such as dredging fines anywhere along these paths would likewise find their way to the intake areas in concentrations comparable to the relative red clay concentration. J.A.M.

**N76-14572*** Minnesota Geological Survey, St. Paul.
**APPLICATIONS OF ERTS IMAGERY TO MAPPINGS SEDIMENTS OF THE TWIN CITIES METROPOLITAN AREA**
J. R. Poppe *In* Minn. Univ. A study of Minn. Forests and Lakes using Data from Earth Resources Technol. Satellites

30 Jun. 1975 30 p refs (For availability see N76-14569 05-43)
CSCL 08B

ERTS images were compared to surficial geologic maps, prepared through traditional field studies. Lithologic boundaries, bedrock outcrops, bedrock structures, and geomorphologic features were examined. An area southeast of the Twin Cities, located chiefly in northern Dakota County was studied, as well as the New Brighton 15-minute quadrangle located in portions of Ramsey and Anoka Counties. Visual comparison of geologic maps and ERTS imagery demonstrated the limitations of this approach to geological investigations. Bedrock outcrops and bedrock structure in the metropolitan area do not appear on ERTS imagery. However, certain glacial sediments can be identified and are potentially mappable. Certain geomorphological features were also discernable. J.A.M.

**N76-14573*** Minnesota Geological Survey, St. Paul.
**APPLICATIONS OF LANDSAT IMAGERY TO GEOLOGICAL RESEARCH IN MINNESOTA**
P. W. Weiblen, G. B. Morey, and M. S. Walton *In* Minn. Univ. A study of Minn. Forests and Lakes using Data from Earth Resources Technol. Satellites 30 Jun. 1975 11 p refs (For availability see N76-14569 05-43)
CSCL 08G

A large part of northeastern Minnesota north of Lake Superior was studied using Landsat images. The area is being studied for its intercontinental rift and for large, low grade, copper-nickel deposits. By using Landsat imagery in conjunction with field data, it is possible to develop a much higher level of continuity and structural resolution in interpretations of the bedrock geology. Preliminary results indicate that it is possible to distinguish various surficial morphological features such as the Vermilion and Highland moraines, the Toimi drumlin field, and an unnamed drumlin field apparently associated with the Highland moraine. J.A.M.

**N76-14574*#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
**SOIL MOISTURE DETECTION FROM RADAR IMAGERY OF THE PHOENIX, ARIZONA TEST SITE**
Josef Cihlar, Fawwaz T. Ulaby, and Raymond Mueller Jun. 1975 40 p refs
(Contract NAS9-14052)
(NASA-CR-144638; RSL-TR-264-4) Avail: NTIS HC $4.00 CSCL 17I

The Environmental Research Institute of Michigan (ERIM) dual-polarization X and L band radar was flown to acquire radar imagery over the Phoenix (Arizona) test site. The site was covered by a north-south pass and an east-west pass. Radar response to soil moisture was investigated. Since the ERIM radar does not have accurately measured antenna patterns, analysis of the L band data was performed separately for each of several strips along the flight line, each corresponding to a narrow angle of incidence. For the NS pass, good correlation between the radar return and mositure content was observed for each of the two nearest (to nadir) angular ranges. At higher angular ranges, no correlation was observed. The above procedure was not applied to the EW pass due to flight path misalignments. The results obtained stress the importance of radar calibration, the digitization process, and the angle of incidence. Author

**N76-14575*#** Department of Agriculture, Washington, D.C.
**NASA CROP CALENDARS: WHEAT, BARLEY, OATS, RYE, SORGHUM, SOYBEANS, CORN**
M. R. Stuckey and E. N. Anderson 17 Jan. 1975 93 p refs Sponsored by NASA
(NASA-CR-145956) Avail: NTIS HC $5.00 CSCL 02C

Crop calenders used to determine when Earth Resources Technology Satellite ERTS data would provide the most accurate wheat acreage information and to minimize the amount of ground verified information needed are presented. Since barley, oats, and rye are considered 'confusion crops, i.e., hard to differentiate from wheat in ERTS imagery, specific dates are estimated for these crops in the following stages of development: (1) seed-bed operation, (2) planting or seeding, (3) intermediate growth, (4) dormancy, (5) development of crop to full ground cover, (6) heading or tasseling, and flowering, (7) harvesting, and (8) posting-harvest operations. Dormancy dates are included for fall-snow crops. A synopsis is given of each states' growing conditions, special cropping practices, and other characteristics which are helpful in identifying crops from ERTS imagery. Author

**N76-14576*#** Ecosystems International, Inc., Gambrills, Md.
**THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS**
Peter A. Castruccio, Harry L. Loats, Jr., Thomas R. Fowler, and Susan L. Frech 7 Jan. 1975 27 p refs
(Contract NAS8-30539)
(NASA-CR-144078; ECO-75-C-2-1) Avail: NTIS HC $4.00 CSCL 08H

Regional hydrologic planning models built upon remote sensing capabilities and suited for ungaged watersheds are developed. The effectiveness of such models is determined along with which parameters impact most the minimization of errors associated with the prediction of peak flow events (floods). Emphasis is placed on peak flood prediction because of its significance to users for the purpose of planning, sizing, and designing waterworks. J.M.S.

**N76-14577*#** Ecosystems International, Inc., Gambrills, Md.
**THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS Final Report**
Peter A. Castruccio, Harry L. Loats, Jr., Thomas R. Fowler, and Susan L. Frech 7 Jan. 1975 196 p refs
(Contract NAS8-30539)
(NASA-CR-144079; ECO-75-C-2-1-F) Avail: NTIS HC $7.50 CSCL 08H

For abstract, see N76-14576.

**N76-14578*#** Lockheed Electronics Co., Houston, Tex.
**S193 RADIOMETER BRIGHTNESS TEMPERATURE PRECISION/ACCURACY FOR SL2 AND SL3**
D. J. Pounds and K. Krishen Jun. 1975 119 p refs
(Contract NAS9-12200)
(NASA-CR-144572; LEC-5976; JSC-09793) Avail: NTIS HC $5.50 CSCL 20F

The precision and accuracy with which the S193 radiometer measured the brightness temperature of ground scenes is investigated. Estimates were derived from data collected during Skylab missions. Homogeneous ground sites were selected and S193 radiometer brightness temperature data analyzed. The precision was expressed as the standard deviation of the radiometer acquired brightness temperature. Precision was determined to be 2.40 K or better depending on mode and target temperature. Author

**N76-14579*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION OPERATIONS: REMOTE SENSING EXPERIMENTS IN THE NEW YORK BIGHT, 7-17 APRIL 1975**
J. W. Usry and J. B. Hall, Jr. Nov. 1975 62 p refs
(NASA-TM-X-72802) Avail: NTIS HC $4.50 CSCL 08B

Results are given of remote sensing experiments conducted in the New York Bight between April 7-17, 1975, to evaluate the role of remote sensing technology to aid in monitoring ocean dumping. Remote sensors were flown on the C-54, U-2, and C-130 aircraft while the National Oceanic and Atmospheric Administration obtained concurrent in situ sea truth data using helicopters and surface platforms. The test site, aircraft platforms, experiments, and supporting sensors are described. The operation of each aircraft are discussed and aircraft flight lines, flight parameters, and data identification parameters are presented in figures and tables. Author

**N76-14580*#** General Electric Co., Philadelphia, Pa. Space Div.
**A LANDMARK RECOGNITION AND TRACKING EXPERIMENT FOR FLIGHT ON THE SHUTTLE/ADVANCED TECHNOLOGY LABORATORY (ATL) Final Report**
J. D. Welch 9 Dec. 1975 88 p refs
(Contract NAS1-12550)

(NASA-CR-144906) Avail: NTIS HC $5.00 CSCL 08B

The preliminary design of an experiment for landmark recognition and tracking from the Shuttle/Advanced Technology Laboratory is described. It makes use of parallel coherent optical processing to perform correlation tests between landmarks observed passively with a telescope and previously made holographic matched filters. The experimental equipment including the optics, the low power laser, the random access file of matched filters and the electro-optical readout device are described. A real time optically excited liquid crystal device is recommended for performing the input non-coherent optical to coherent optical interface function. A development program leading to a flight experiment in 1981 is outlined. Author

**N76-14581#** Chem Systems, Inc., New York.
**CHEMICALS FROM COALS AND SHALE AN R AND D ANALYSIS FOR NATIONAL SCIENCE FOUNDATION Final Report, May 1974 - Jul 1975**
Martin B. Sherwin and Marshall E. Frank Jul. 1975 442 p refs
(Grant NSF EN-43237)
(PB-243393/6) Avail: NTIS HC $11.75 CSCL 07A

An analysis was made of the economic and technical factors involved in the manufacture of primary organic chemicals such as olefins, aromatics, acetylene, ammonia, and methanol from coal and shale. The technologies discussed are compared to present conventional technology which is based upon oil and natural gas. Chemical market demands and feedstock demands to the year 2000 are projected to estimate when coal and shale based processes would be required. The above inputs are utilized in outlining a research program which would insure the availability of this new technology. GRA

**N76-14582#** Army Engineer Topographic Labs., Fort Belvoir, Va.
**AUTOMATIC TYPE/SYMBOL PLACEMENT DEVELOPMENTS Technical Report, Oct. 1971 - Nov. 1973**
John H. Garlow Mar. 1975 36 p refs
(AD-A013977; ETL-TR-74-9) Avail: NTIS CSCL 08/2

This report covers current efforts, including both in-house and contracted work, by the Automated Cartography Branch of the U.S. Army Engineer Topographic Laboratories (USAETL) toward development of an automated type/symbol-placement system for the production of topographic maps. Investigations into computer generated type and plotting methods are reported in six categories: (1) Hershey Typographic System; (2) mechanical plotter with Cathode Ray Tube (CRT) plotting head; (3) electron beam recording; (4) raster drum-scanner/plotter approach; (5) digital editing equipment; and (6) digital type/symbol-font acquisition. GRA

**N76-14583#** Association of American Geographies, Washington, D.C.
**USING REMOTE SENSOR DATA FOR LAND USE MAPPING AND INVENTORY: A USER GUIDE Final Interagency Report**
Joseph W. Wiedel and Richard Kleckner Jul. 1974 124 p refs
(Contract DI-14-08-0001-13702)
(PB-242813/4; IR-USGS-253; USGS-LI-75-002) Avail: NTIS HC $5.50 CSCL 08B

Various techniques for obtaining and analyzing land use data are described. Topics discussed include: geographic applications program and test sites; acquisition of high altitude photography and ERTS-1 imagery for land use mapping; supplemental source material; plotting bases; land use classifications using remote sensor data; land use interpretation and map compilation field verification of land use mapping; geographic information systems. GRA

**N76-14584#** JRB Associates, La Jolla, Calif.
**INFRARED SENSOR FOR THE REMOTE MONITORING OF SO2 Final Report**
E. R. Bartle and E. A. Meckstroth May 1975 55 p refs
(Contract EPA-68-02-1208)
(PB-243478/5; EPA-650/2-75-041) Avail: NTIS HC $4.50 CSCL 17E

A prototype passive infrared sensor for the measurement of sulfur dioxide emissions from stationary sources is described. The infrared radiation emitted by gases in a plume originating from smokestacks may be detected, and from this the SO2 concentration in the plume may be determined. In general, the radiation received by the sensor is a function of the intervening and background atmosphere. Thus, the problem of quantitative measurements is generally complex. A technique is described, based upon the principle of Gas Filter Correlation, which minimizes these effects. This report presents a detailed description of the sensor, its specifications, and performance characteristics. The results of field testing at both oil and coal-burning power plants are compared with extractive sample data. In general, the remote measurements agree with the extractive data within + or - 25 percent over SO2 concentrations ranging from 150ppm to 1300ppm from slant ranges of 130 to 400 m. GRA

**N76-14585#** Geological Survey, Sioux Falls, S. Dak.
**ERTS IMAGE INTERPRETATION WORKSHOP: SYLLABUS**
Jun. 1974 550 p refs Workshop held at Sioux Falls, S. D., 30 May - 28 June 1974 Sponsored in part by AID
(PB-243933/9; USGS/OFR-75/196) Avail: NTIS HC $13.00 CSCL 08F

Training of engineers, scientists, and managers involved in resources investigations of the use of remotely sensed data, especially that provided by ERTS-1 and similar satellites is outlined. The value of remote sensing to interdisciplinary/multidisciplinary cooperation in environmental analyses, resource inventories, and land-use planning is emphasized. GRA

**N76-14586#** Massachusetts Inst. of Tech., Cambridge. Sea Grant Project Office.
**IMPACTS OF OFFSHORE OIL ON NORTH EAST SCOTLAND**
John Hutton (North East Scotland Develop. Authority) 1 Jun. 1975 33 p Lecture held 28 Apr. 1975 Sponsored by NOAA
(COM-75-11026/2; MITSG-75-15; NOAA-75070804) Avail: NTIS HC $4.00 CSCL 08I

Massachusetts, along with other New England states, will face great economic, social, and environmental challenges from proposed offshore oil development on Georges Band and the Outer Continental Shelf beyond Cape Cod. Northeast Scotland has faced, and to some extent resolved, similar challenges created by the rapid construction of facilities for extracting, processing, and transporting petroleum from the rich North Sea oil fields. To acquaint New England with Northeast Scotland's experiences and problems in coping with the onshore impacts of offshore oil development, the MIT Sea Grant Program sponsored this lecture by Mr. John Hutton of the North East Scotland Development Authority. GRA

**N76-14587#** Texas Governor's Energy Advisory Council, Austin.
**PETROCHEMICALS IN TEXAS, 1972 Final Report**
30 Jan. 1974 84 p
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243355/5; NSF/RA/N-74-259) Avail: NTIS HC $5.00 CSCL 10A

A comparison is presented of the present status of major petrochemicals in Texas with the remainder of the United States including: Ethylene, propylene, benzene, toluene/xylenes, butanes/butylenes, carbon black and elastomers, and ammonia/methanol. GRA

**N76-14588#** Texas Governor's Energy Advisory Council, Austin.
**ASSESSMENT OF ENHANCED RECOVERY TECHNOLOGY AS A MEANS FOR INCREASING TOTAL CRUDE OIL RECOVERY IN TEXAS Final Report**
E. Alan Lohse 6 Jan. 1975 78 p Prepared by Gulf Univ. Res. Consortium
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243347/2; NSF/RA/N-74-251; GURC-141) Avail: NTIS HC $5.00 CSCL 08I

Enhanced recovery (ER) refers to chemical and/or thermal treatment of oil reservoirs to increase the production of crude oil beyond those amounts recoverable by natural reservoir energy (primary recovery, by water drive or gas pressure) or by artificial maintenance of reservoir energy (secondary recovery by waterflood or gas injection). Current ER methods consist of (1) polymers to thicken reservoir water for more uniform sweep

of water through the reservoir, (2) miscible fluids to reduce interfacial tension between the reservoir rock's very small pore spaces and the oil, or (3) heat applied in some form such as steam or underground combustion. Analyses of 242 Texas oil fields as a representative sample of the Texas oil resource are presented. GRA

**N76-14589#** Texas Governor's Energy Advisory Council, Austin.
**ASSESSMENT OF ENHANCED RECOVERY TECHNOLOGY AS A MEANS FOR INCREASING NATURAL GAS RECOVERY IN TEXAS Final Report**
E. Alan Lohse Dec. 1974 45 p refs Prepared by Gulf Univ. Res. Consortium
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243348/0; NSF/RA/N-74-252; GURC-142) Avail: NTIS HC $4.00 CSCL 08I

Enhanced recovery methods to create a system of underground fractures in a gas reservoir are discussed, thereby increasing the internal surface area through which gas can migrate through the reservoir rock into the well bore, at an increased rate sufficient to be of economic value. GRA

**N76-14590#** Mitre Corp., McLean, Va.
**WESTERN COAL DEVELOPMENT AND UTILIZATION. A POLICY ORIENTED, SELECTED BIBLIOGRAPHY WITH ABSTRACTS Final Report**
D. Ellis and T. Bercal Jul. 1975 465 p refs
(Grant NSF C-925)
(PB-244271/3; MTR-6963) Avail: NTIS HC $12.00 CSCL 08I

This bibliography is an aid to the identification and understanding of policy issues related to the development and use of western coal. It provides a means of facilitating communication among those involved in the related research. The research cited is directed at the states most affected by the expanded development of western coal resources. In addition, research is included which, while not directly addressing western coal, assists in the understanding of policies and problems related to its increased production. GRA

**N76-14591#** Mitre Corp., McLean, Va.
**ANALYSIS OF A NATIONAL COAL RESERVE PROGRAM**
J. Bhutani, A. Brice, J. Clark, J. DeCarlo, and J. Elliott Apr. 1975 122 p refs
(Contract FEA-C-05-50110-00)
(PB-244180/6; MTR-6877; FEA/G-75/430) Avail: NTIS HC $6.00 CSCL 08I

The establishment of a national coal reserve is considered that contains the equivalent of six months of domestic coal production as suggested in Congressional legislation. The purpose served was to test the impact of the production, transport, and storage of that amount of coal. GRA

**N76-14592#** Federal Energy Administration, Washington, D.C. Office of Energy Resource Development.
**INITIAL REPORT ON OIL AND GAS RESOURCES, RESERVES, AND PRODUCTIVE CAPACITIES**
Jun. 1975 243 p
(PB-243581/6; FEA/G-75/360) Avail: NTIS HC $8.00 CSCL 08I

Preliminary estimates show that, as of December 31, 1974, the United States had proved reserves of 38.2 billion barrels of crude oil and 237 trillion cubic feet of natural gas. The preliminary estimates are based on a survey of all oil and gas field operators in the United States. The results of the survey are detailed. Estimates of oil and natural gas resources prepared by USGS. GRA

**N76-14593#** Bureau of Mines, Dallas, Tex. Mineral Supply Field Office.
**DEPTH AND PRODUCING RATE CLASSIFICATION OF PETROLEUM RESERVOIRS IN THE UNITED STATES, 1971**
W. D. Dietzman Jul. 1975 29 p
(PB-244368/7; BM-IC-8675) Avail: NTIS HC $4.00 CSCL 08I

This report presents statistics pertaining to distribution of petroleum reservoirs (or fields), wells, and production by depth and producing rate classification in the United States. Data are presented in tabular form by state for the 18 principal oil-producing states and by subdivision for the two largest oil producing states, Texas and Louisiana. Tabular summations and graphical illustrations are presented for the nation. The data are classified by four-barrels-of-oil-per-day rate increments up to 36 barrels and one increment of greater than 36 barrels of oil per day and 2,000-foot depth increments up to 8,000 feet and one depth increment of greater than 8,000 feet. GRA

## 44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

**N76-14594** British Library Lending Div., Boston Spa (England).
**SITUATION AND DEVELOPMENT OF DISTRICT HEATING IN UNICHAL MEMBER COUNTRIES**
[1975] 35 p Transl. into ENGLISH from Fernwarme Intern. (West Germany), v. 3, no. 1, 1974 p 3-12
(BLL-CE-Trans-6668-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The development of district heat supply in ten member countries of UNICHAL is described. The method of heat generation, the fuel used, the consumer structure, the competitive situation, and the expected trend of development are briefly examined. In the light of the most recent developments in the fuel market, the expectations regarding future annual growth rates in district heat supply are likely to be fully confirmed and probably exceeded. Author

**N76-14595*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**PANEL FOR SELECTIVELY ABSORBING SOLAR THERMAL ENERGY AND THE METHOD OF PRODUCING SAID PANEL Patent**
James R. Lowery, inventor (to NASA) Issued 18 Nov. 1975 7 p Filed 5 Apr. 1974 Supersedes N74-19700 (12 - 17, p 1249)
(NASA-Case-MFS-22562-1; US-Patent-3,920,413; US-Patent-Appl-SN-458484; US-Patent-Class-29-197; US-Patent-Class-29-194; US-Patent-Class-29-195; US-Patent-Class-126-270; US-Patent-Class-204-32R; US-Patent-Class-204-33; US-Patent-Class-204-38A; US-Patent-Class-204-40; US-Patent-Class-204-42; US-Patent-Class-204-49; US-Patent-Class-136-206) Avail: US Patent Office CSCL 10A

A panel is described for selectively absorbing solar thermal energy comprised of a metallic substrate, a layer of bright metallic material carried on the substrate, and a solar thermal energy absorbing coating carried on the bright metallic material. A layer of zinc is interposed between the metal substrate and the layer of bright material or the metallic substrate can be anodized for receiving the layer of bright metallic material. Also disclosed is the method for producing the coating which selectively absorbs solar thermal energy. Official Gazette of the U.S. Patent Office

**N76-14596** British Library Lending Div., Boston Spa (England).
**CAN FLYWHEELS REPLACE PUMPED STORAGE?**
T. Ginsburg [1974] 14 p refs Transl. into ENGLISH from Neue Zuercher Zeitung (West Germany), 15 Jul. 1974 p 15-16
(BLL-CE-Trans-6761-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The feasibility of using a system of modern flywheels for energy storage is considered. Topics discussed include: energy storage as a buffer between production and consumption; energy storage capacity of a flywheel; fiber-reinforced plastics; design

of a flywheel in terms of material selection; and economic and environmental factors. The concept of decentralized energy storage (flywheels) is compared to centralized energy storage (pumped storage stations) with emphasis on environmental and cost factors. J.M.S.

**N76-14597** British Library Lending Div., Boston Spa (England).
**SYSTEMS OF CYBERNETIC SIMULATION OF POWER SYSTEMS**
V. A. Venikov and Q. A. Sukhanov [1975] 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transp. (Moscow), no. 3, 1974 p 112-122
(BLL-CE-Trans-6723-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

The mathematical methodology for calculating electric potential and impedances is discussed. Mathematical models, transformations, volterra equations, and algorithms are considered. Digital techniques are discussed, and block diagrams of electrical power systems and circuits are shown. The Kirchhoff law for electrical circuits and networks is also discussed. J.R.T.

**N76-14598** Southern Methodist Univ., Dallas, Tex.
**POLYCRYSTALLINE SILICON SOLAR CELL Ph.D. Thesis**
Kailash Narain Singh 1975 148 p
Avail: Univ. Microfilms Order No. 75-29144

The fabrication and characterization of epitaxial silicon solar cells on metallurgical grade polycrystalline silicon substrates was studied. Metallurgical silicon substrates were prepared by unidirectional solidification of the melt in a boron nitride container. The chemical, structural, and electrical properties of the substrates were investigated. Solar Cell structures were deposited on metallurgical and single crystalline substrates by the thermal decomposition of silane and thermal reduction of trichlorosilane with appropriate dopants. Limited studies on the effect of thickness and dopant concentration in the deposited silicon layers were carried out. The current-voltage measurements on the deposited p-n junctions indicated the recombination dominant characteristics in polycrystalline junctions over an extended voltage range and diffusion dominant characteristics in single crystalline junctions. The characteristics of solar cell fabricated on both metallurgical and single crystalline substrates were compared. Dissert. Abstr.

**N76-14599** Arizona Univ., Tucson.
**A SILICON JUNCTION SOLAR ENERGY CONVERTER Ph.D. Thesis**
Raymond Joseph Balda 1975 85 p
Avail: Univ. Microfilms Order No. 75-26930

A description of a lateral collection pin solar cell is described. An intrinsic region serves as the active generation region of the cell, thus allowing long diffusion lengths for the optically generated carriers. Collecting junctions are formed in isotropically etched grooves which traverse the thickness of the cell in a nearly vertical manner. A method for the fabrication of this silicon device is presented, and processing problems which were encountered are discussed. Testing of this solar cell was carried out in sunlight, and a method of determining the solar input power at the earth's surface based on the atmospheric attenuation is illustrated. A mathematical model of this lateral collection device was derived which accounts for the solar spectral distribution, atmospheric attenuation, and the silicon optical absorption coefficient. Computer solutions of the model are presented, and the results provide an insight to the effects of material parameters and device design on the overall performance of this pin solar energy converter. Dissert. Abstr.

**N76-14600*** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**COVERED SILICON SOLAR CELLS AND METHOD OF MANUFACTURE Patent**
Jacob D. Broder, inventor (to NASA) Issued 14 Oct. 1975 4 p Filed 18 Jun. 1973 Supersedes N73-26048 (11 - 17, p 1985) Continuation-in-part of abandoned US Patent Appl. SN-154930, filed 21 Jun. 1971
(NASA-Case-LEW-11065-2; US-Patent-3,912,540; US-Patent-Appl-SN-371322; US-Patent-Class-136-89; US-Patent-Class-29-572; US-Patent-Appl-SN-154930) Avail: US Patent Office CSCL 10A

A glass covered solar cell utilizing a thin film of plastic material as the binding material is described. The binding material provides the following characteristics: its short circuit current response is unaffected by ultraviolet radiation exposure and its bonding characteristics are not degraded under particular radiation bombardment. Official Gazette of the U.S. Patent Office

**N76-14601*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**RAPID ACTIVATION AND CHECKOUT DEVICE FOR BATTERIES Patent**
William J. Britz and William A. Boshers, inventors (to NASA) Issued 14 Oct. 1975 6 p Filed 27 Jun. 1974 Supersedes N74-34861 (12 - 24, p 2948)
(NASA-Case-MFS-22749-1; US-Patent-3,912,541; US-Patent-Appl-SN-483857; US-Patent-Class-136-90; US-Patent-Class-136-114; US-Patent-Class-136-162; US-Patent-Class-136-182) Avail: US Patent Office CSCL 10C

An apparatus developed to activate a battery by inserting an electrolyte into the cells while concurrently making voltage measurements on each cell is described. The battery has a planar top with vertically extending passages providing access to the cells. It also has test points adjacent each cell. A housing is mounted on top of the battery for supplying an electrolyte through sealed passages into the cells while simultaneously checking the voltage of the cells. The electrolyte is forced by pressure into the battery. Official Gazette of the U.S. Patent Office

**N76-14602*** National Aeronautics and Space Administration. Pasadena Office, Calif.
**THERMOSTATICALLY CONTROLLED NON-TRACKING TYPE SOLAR ENERGY CONCENTRATOR Patent**
Katsunori Shimada, inventor (to NASA) (JPL) Issued 28 Oct. 1975 9 p Filed 22 Nov. 1974 Supersedes N75-12429 (13 - 03, p 0316) Sponsored by NASA
(NASA-Case-NPO-13497-1; US-Patent-3,915,148; US-Patent-Appl-SN-526448; US-Patent-Class-126-271; US-Patent-Class-237-1A; US-Patent-Class-350-211) Avail: US Patent Office CSCL 10A

A solar energy concentrator composed of an array of cylindrical Fresnel lenses, all of which are fixedly aligned in the east-west direction was developed. Each lens concentrates the sun rays and forms a line image which extends in the east-west direction. Located below the lenses are individual fluid channels which extend in the east-west direction and are spaced apart in the south-north direction. Each line image focuses onto not more than two of the channels which absorb heat of the concentrated sun rays. Each channel has a thermostatically controlled valve which controls fluid flow through the channel to take place only when the channel's temperature and/or the fluid exceed a threshold temperature level.
Official Gazette of the U.S. Patent Office

**N76-14603#** Bechtel Corp., San Francisco, Calif.
**FUELS FROM MUNICIPAL REFUSE FOR UTILITIES: TECHNOLOGY ASSESSMENT Final Report**
Mar. 1975 181 p refs Sponsored by Elec. Power Res. Inst.
(EPRI-261-1) Avail: NTIS HC $7.50

Methods of processing municipal solid wastes are presented. Six types of processes available to prepare or use muncipal solid wastes (MSW) are examined. They are: (1) preparation of MSW as a solid fuel, (2) pyrolysis of MSW to a fuel gas, (3) pyrolysis of MSW to a fuel oil, (4) anaerobic digestion of landfilled MSW to a fuel gas, (5) fluid-bed combustion/gas turboelectric generation, and (6) incineration of MSW with heat recovery. Flow charts and diagrams of the processes are included, along with cost estimates. J.R.T.

**N76-14604#** National Academy of Sciences - National Research Council, Washington, D.C. Commission on Sociotechnical Systems.
**MATERIALS TECHNOLOGY IN THE NEAR-TERM ENERGY PROGRAM**
1974 133 p refs
(Contract NSF C-310)
Avail: NTIS HC $6.00

A semiquantitative measure is given of the influence which

a given materials program might have on the energy supply/demand balance in 1985. The resulting sensitivity indices indicate that only a few program areas can have significant impact in this time frame. The most important programs from the materials point of view with respect to degree of impact are (1) pressure vessels in the nuclear power plants, (2) oil shale, (3) coal liquefaction, (4) fuel and materials recycling from municipal and agricultural waste, (5) coal gasification, (6) high temperature turbines, and (7) hot water geothermal. Other programs considered are judged to have less impact in this time frame: solar heating, extractive metallurgy processing, fuel cells, U-235 separation, and batteries and flywheels for energy storage. Research areas common to many of the energy programs are briefly summarized. Author

**N76-14605*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**INSTALLATION AND INITIAL OPERATION OF A 4100 WATT WIND TURBINE**
Henry B. Tryon and Timothy Richards Dec. 1975 29 p
(NASA-TM-X-71831) Avail: NTIS HC $4.00 CSCL 10A

The results are presented of 211 days of operation of the 4.1 kilowatt wind turbine, which was the largest commercially available wind turbine. The wind turbine, electric controls and load bank, and the pivoted tower are described. F.O.S.

**N76-14606*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Structure and Propulsion Lab.
**CONSIDERATIONS FOR PERFORMANCE EVALUATION OF SOLAR HEATING AND COOLING SYSTEMS**
J. W. Littles and J. C. Cody 14 Nov. 1975 23 p refs
(NASA-TM-X-64969) Avail: NTIS HC $3.50 CSCL 10A

One of the many factors which must be considered in performance evaluation of solar energy systems is the relative merit of a given solar energy system when compared to a standard conventional system. Although initial and operational costs will be dominant factors in the comparison of the two types of systems and will be given prime consideration in system selection, sufficient data are not yet available for a definitive treatment of these variables. It is possible, however, to formulate relationships between the nonsolar energy requirements of the solar energy systems and the energy requirements of a conventional system in terms of the primary performance parameters of the systems. Derivations of such relationships, some parametric data for selected ranges of the performance parameters, and data with respect to limiting conditions are presented. Author

**N76-14607#** Committee on Ways and Means (U. S. House).
**THE ENERGY CRISIS AND PROPOSED SOLUTIONS. PART 2: TAX POLICY IN THE ENERGY SECTOR, INTERNATIONAL FINANCIAL ASPECTS OF THE ENERGY PROBLEM**
Washington GPO 1975 554 p refs Panel discussions before Comm. on Ways and Means, 94th Congr., 1st Sess., 3-7 Mar., 10-14 Mar. and 17 Mar. 1975
(GPO-49-488) Avail: Comm. on Ways and Means

Proposed solutions to the energy crisis are discussed. Areas covered include: tax policy; international financial aspects of the energy problem; petroleum supply; gas and other energy sources; automobile efficiency and conservation; industrial, agriculture, and home energy problems; and transportation. For Vol. 1, see N76-11556. J.M.S.

**N76-14608#** Committee on Ways and Means (U. S. House).
**THE ENERGY CRISIS AND PROPOSED SOLUTIONS. PART 3: PETROLEUM SUPPLY, GAS AND OTHER ENERGY SOURCES, AUTOMOBILE EFFICIENCY AND CONSERVATION**
Washington GPO 1975 489 p refs Panel discussions before Comm. on Ways and Means, 94th Congr., 1st Sess., 3-7 Mar., 10-14 Mar. and 17 Mar. 1975
(GPO-50-130) Avail: Comm. on Ways and Means
For abstract, see N76-14607.

**N76-14609#** Committee on Ways and Means (U. S. House).
**THE ENERGY CRISIS AND PROPOSED SOLUTIONS. PART 4: INDUSTRIAL, AGRICULTURAL, AND HOME ENERGY PROBLEMS, TRANSPORTATION, ADDITIONAL TESTIMONY FROM GOVERNMENT OFFICIALS**
Washington GPO 1975 506 p refs Panel discussions before Comm. on Ways and Means, 94th Congr., 1st Sess., 3-7 Mar., 10-14 Mar. and 17 Mar. 1975
(GPO-50-199) Avail: Comm. on Ways and Means
For abstract, see N76-14607.

**N76-14610*#** Scientific Translation Service, Santa Barbara, Calif.
**EFFECTIVENESS OF USING ABSORPTION AND COMPRESSOR REFRIGERATION MACHINES IN CENTRAL HEATING AND COOLING SYSTEMS**
L. M. Rosenfeld and V. F. Gershkovich Washington NASA Dec. 1975 9 p Transl. into ENGLISH from Izv. Sib. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk (USSR), no. 13, issue 3, 1972 p 153-156
(Contract NASw-2791)
(NASA-TT-F-16806) Avail: NTIS HC $3.50 CSCL 13A

Three power systems which release an equal amount of electrical energy, cold and heat are examined. Schematic diagrams of these power systems are presented. Author

**N76-14611*#** Scientific Translation Service, Santa Barbara, Calif.
**DISCHARGE DATA OF LEAD BATTERIES AND THEIR INFLUENCE ON THE OPTIMIZATION OF THE STORAGE CAPACITY OF ELECTRICAL VEHICLES**
Wolfgang Runge Washington NASA Dec. 1975 12 p refs Transl. into ENGLISH from Elektrotech. Z., Ausgabe (West Ger.), v. 94, no. 2, Feb. 1973 p 83-86
(Contract NASw-2791)
(NASA-TT-F-16821) Avail: NTIS HC $3.50 CSCL 10C

A generalized analytical expression is found for the useful capacity and average discharge voltage as a function of the discharge current of a lead accumulator. The temperature influence is taken into account. From this it is possible to establish a relationship between the energy which can be drawn off and the power level at which the accumulator is loaded. It is found that the optimum of the storage unit fraction at which the product of range and remaining payload of the vehicle becomes a maximum depends practically only on two parameters. These are the empty mass fraction of the vehicle without the storage unit and the discharge parameter which describes the capacity decrease when the discharge current is increased. Author

**N76-14612*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SOLAR CELL SURFACE TREATMENT Patent Application**
Henry W. Brandhorst, Jr. and Cosmo R. Barona, inventors (to NASA) Filed 18 Dec. 1975 13 p
(NASA-Case-LEW-11330-1; US-Patent-Appl-SN-642083) Avail: NTIS HC $3.50 CSCL 10A

A patent application dealing with an improvement to solar cells was presented. The improvement consists in increasing the anti-reflecting properties of silicon solar cells by the formation of grooves on the surface of the cells using a chemical etchant. The novelty of the invention resides not only in the formation of grooves that produce multiple reflection of light to enhance absorption but also the utilization of internal reflection that takes place as a result of the crystallographic orientation of the solar cell. This results in more charge carriers being generated close to the junction region than is possible with conventional solar cells with normal angles of light incidence. Author

**N76-14613*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SILICON NITRIDE COATED, PLASTIC COVERED SOLAR CELL Patent Application**
Jacob D. Broder, inventor (to NASA) Filed 30 Dec. 1975 8 p
(NASA-Case-LEW-11496-1; US-Patent-Appl-SN-645508) Avail: NTIS HC $3.50 CSCL 10A

A patent application dealing with a technique to increase the resistance to damage to silicon solar cells caused by electron bombardment was presented. A non-oxide anti-reflective coating is used with a transparent plastic cover of fluorinated ethylene propylene copolymer over the solar cell. An important advantage results from the use of silicon nitride as the coating material instead of the conventional silicon oxide. Even if the silicon nitride is as susceptible to fluorine attack as the silicon oxide, the

silicon nitride will not liberate oxygen to cause embrittlement of the Teflon FEP cover. Author

**N76-14614#** EIC, Inc., Newton, Mass.
**LITHIUM-INORGANIC ELECTROLYTE BATTERIES Quarterly Report, 16 Dec. 1974 - 15 Mar. 1975**
Gerhard L. Holleck, Joseph R. Driscoll, and David E. Toland Jul. 1975 36 p refs
(Contract DAAB07-74-C-0030; DA Proj. 1T1-61102-A-34A) (AD-A013420; C-401-6; ECOM-74-0030-6; QR-6) Avail: NTIS CSCL 10/3

An all-inorganic electrolyte, lithium primary battery operable over the temperature range -40 to +160 F is being evaluated. The desired energy density is 150 watt-hours per pound of total battery weight and the desired power density is 50 watts per pound. GRA

**N76-14615#** Texas Governor's Energy Advisory Council, Austin.
**EXISTING ENERGY LAW AND REGULATORY PRACTICE IN TEXAS Final Report**
Tom Edwards, John Gangstad, and Row Sandberg 21 Nov. 1974 108 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243334/0; NSF/RA/N-74-238) Avail: NTIS CSCL 10A

Federal and state law affecting the production and use of energy in Texas is surveyed. The principal federal and state statutes dealing with exploration, production, processing and conversion, transportation/transmission, distribution, and use of energy and relevant environmental restraints are summarized. Indexing and cross-referencing to administrative practices, caselaw, and more intensive scholarly analysis and commentary are included. GRA

**N76-14616#** Texas Governor's Energy Advisory Council, Austin. Legal and Regulatory Policy Committee.
**ENERGY CONSERVATION Final Report**
Steve Van, ed., Joyce Carpenter, and Marc Wiegand 25 Nov. 1974 119 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243335/7; NSF/RA/N-74-239) Avail: NTIS HC $5.50 CSCL 10A

Various ways to conserve energy in the residential, commercial, transportation, industrial, and electric utilities sectors are discussed. Legal issues involved are noted. GRA

**N76-14617#** Texas Governor's Energy Advisory Council, Austin.
**THE IMPACT OF AND POTENTIAL FOR ENERGY CONSERVATION PRACTICES IN RESIDENTIAL AND COMMERCIAL BUILDINGS IN TEXAS Final Report**
Raymond D. Reed (Texas A and M Univ., College Station) 10 Dec. 1974 130 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243323/3; NSF/RA/N-74-228) Avail: NTIS HC $6.00 CSCL 10A

This study deals with the potential to conserve energy in the residential and commercial areas through the application of conservation oriented design practices and selected urban design and planning concepts. Profiles of energy consumption in the residential and commercial areas are reviewed and documented for comfort heating, cooking, and comfort cooling. Some of the many variables associated with the design of the built environment and their relationship to energy are reviewed. The spectrum of climatic conditions that exist in Texas is identified, categorized and studied to reflect more efficient energy uses as well as an architecture that supports rather than negates climatic factors. GRA

**N76-14618#** Aerospace Corp., El Segundo, Calif. Water Resources Research Inst.
**SOLAR THERMAL CONVERSION CENTRAL RECEIVER PILOT PLANT SITING**
31 Jan. 1975 151 p refs
(Contract NSF C-933)
(PB-243752/3; ATR-75(7370)-3; NSF/RA/N-75-039C) Avail: NTIS HC $6.75 CSCL 10A

Technical and institutional criteria were developed and applied to identify twenty potentially suitable general locations. Facilities exist at these locations that could potentially supply logistical support during design, construction, and operation (at some locations) of the POCE. These potentially suitable locations were subsequently examined to assess climatological factors and to identify typical sites within the general area. A total of 29 sites were identified in the six southwestern states of Arizona, California, New Mexico, Nevada, Oklahoma, and Texas. Both favorable and unfavorable climatological features were identified at each site. GRA

**N76-14619#** Aerospace Corp., El Segundo, Calif. Energy and Resources Div.
**CENTRAL RECEIVER SOLAR THERMAL POWER SYSTEM: REVIEW AND SUMMARY OF AVAILABLE TEST FACILITIES**
Jan. 1975 72 p refs
(Contract NSF C-933)
(PB-243751/5; ATR-75(7370)-2; NSF/RA/N/75-039B) Avail: NTIS HC $4.50 CSCL 10A

The results are given of a study to define siting criteria and identify alternative solar power plant sites for a planned 10 MWe Central Receiver Proof-of-Concept Experiment (POCE) Pilot Plant. Technical and institutional criteria were developed and applied to identify twenty potentially suitable general locations. Facilities exist at these locations that could potentially supply logistical support during design, construction, and operation (at some locations) of the POCE. GRA

**N76-14620#** Texas Governor's Energy Advisory Council, Austin.
**STATE/FEDERAL REGULATION OF NATURAL GAS Final Report**
Mark Lee 29 Oct. 1974 59 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243339/9; NSF/RA/N-74-243) Avail: NTIS HC $4.50 CSCL 10A

Possible governmental responses to the disequilibrium in the supply of and the demand for natural gas are evaluated. The approach includes research and the relevant literature, statutes, cases, governmental reports, quantitative data, and proposed legislation. GRA

**N76-14621#** Texas Governor's Energy Advisory Council, Austin.
**POTENTIAL OF SOLAR ENERGY FOR TEXAS Final Report**
A. F. Hildebrandt (Houston Univ.) 15 Nov. 1974 44 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PR-243344/9; NSF/RA/N-74-248) Avail: NTIS HC $4.00 CSCL 10A

Evaluated is the rapidly growing solar energy program and it is determined which areas are appropriate for immediate development in Texas. Home heating and cooling via solar energy as well as integration of solar energy into electric and gas utilities are considered. GRA

**N76-14622#** Texas Governor's Energy Advisory Council, Austin.
**RESOURCES AND UTILIZATION OF TEXAS LIGNITE Final Report**
T. F. Edgar (Tex. Univ., Austin) and J. T. Richardson (Houston Univ., Tex.) 15 Nov. 1974 229 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243343/1; NSF/RA/N-74-247) Avail: NTIS HC $8.00

The Texas lignite resources and their use is evaluated. Specific areas covered include: (1) supplies of domestic and Texas coals: (2) transportation of coal and coal-derived energy; (3) conversion of coal to other energy forms; (4) synthetic fuel demand; (5) environmental factors in use of coal; and (6) research and development strategy for use of lignite. GRA

**N76-14623#** Southern Methodist Univ., Dallas, Tex.
**DEVELOPMENT OF LOW-COST THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS FOR TERRESTRIAL APPLICATIONS Semiannual Progress Report, 1 Jan. - 30 Jun. 1975**
Ting L. Chu Jul. 1975 59 p refs Prepared in part by Tex. Instr., Inc.
(Grants NSF AER-73-07843; NSF GI-38981)
(PB-243810/9; NSF/RA/N-75-048) Avail: NTIS HC $4.50 CSCL 10B

Silicon deposited on carbon/graphite substrates are similar to silicon deposited on graphite substrates in microstructure, crystallographic properties, and solar cell characteristics. A zone-melting technique was developed for the recrystallization

of silicon on graphite substrates. Silicon solar cells with AMO efficiencies up to 2.5 percent were produced. The grain boundary effects in silicon solar cells of the configuration n(+)/p/cast metallurgical-grade silicon were reduced by increasing the dopant concentration in the p-layer, and AMO efficiencies up to 3.5 percent were obtained. Solar cells deposited on Czochralski polycrystalline metallurgical silicon substrates had higher efficiencies, about 4.2 percent. Metallurgical silicon was purified by the chemical treatment of the melt and float-zone refining. GRA

**N76-14624#** Federal Energy Administration, Washington, D.C. Office of Quantitative Methods.
**NATIONAL PETROLEUM PRODUCT SUPPLY AND DEMAND, 1975 Quarterly Report, Oct. - Dec. 1975**
25 Mar. 1975 227 p refs
(PB-243413/2; FEA-EATR-75-5; FEA/B-75/271) Avail: NTIS HC $8.00 CSCL 21D

This report presents a documentation of the short-term petroleum product supply and demand forecasting methodology. In addition, two petroleum product supply and demand forecasts are presented for the period February through June 1975 by month and for the remainder of 1975 by quarter. The two forecasts represent a base case and a policy option case. GRA

**N76-14625#** Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
**COAL-PYRITE FLOTATION: A MODIFIED TECHNIQUE USING CONCENTRATED SECOND STAGE PULP Technical Progress Report**
Kenneth J. Miller May 1975 16 p refs
(PB-243795/2; BM-TPR-91) Avail: NTIS HC $3.50 CSCL 21D

The Bureau of Mines two-stage coal-pyrite flotation process was modified to provide a more concentrated final clean coal slurry underflow that could be dewatered economically by filtration or centrifugation. This was accomplished by doing the first-stage coal flotation step in the conventional manner with a slurry of about 8 percent solids but running the second-stage pyrite flotation step with undiluted coal froth concentrate containing about 25 percent solids. The final clean coal underflow produced by the new technique contained between 26 and 30 percent solids; this pulp was sufficiently concentrated to be filtered industrially without further thickening. Sulfur removal was equal to that obtained using dilute second-stage pulp. GRA

**N76-14626#** Nuclear Regulatory Commission, Washington, D.C. Office of Nuclear Reactor Regulation.
**SAFETY EVALUATION REPORT RELATED TO CONSTRUCTION OF SUMMIT POWER STATION UNITS 1 AND 2. DELMARVA POWER AND LIGHT COMPANY, SUPPLEMENT NO. 2, DOCKET NOS. 50-450 AND 50-451**
Aug. 1975 16 p
(PB-244196/2; NUREG-75/004-Suppl-2) Avail: NTIS HC $3.50 CSCL 18E

Supplement No. 2 to the Safety Evaluation Report of the Delmarva Power and Light Company's application for licenses to construct and operate its proposed Summit Power Station, Units 1 and 2, to be located south of the Chesapeake and Delaware Canal in New Castle County, Delaware, has been prepared by the Office of Nuclear Regulation, Nuclear Regulatory Commission. The supplement consists of the staff's evaluation of additional information received from Delmarva Power and Light Company since issuance of Supplement No. 1 to the Safety Evaluation Report in May 1975. With this supplement, all of the outstanding items have now been reviewed by the staff and found to be acceptable. GRA

**N76-14627#** Battelle Columbus Labs., Ohio.
**STUDY OF A FISSION POWER REACTOR DEVELOPMENT STRATEGY FOR THE UNITED STATES Interim Report, Dec. 1974 - May 1975**
W. M. Pardue, R. S. Denning, M. Pobereskin, R. L. Ritzman, and J. D. Waddell 25 Jul. 1975 404 p refs
(Contract NSF C-946)
(PB-243943/8; BCL/NSF/C946-1) Avail: NTIS HC $11.00 CSCL 18E

The study described in this report is a continuation of a multistage effort to provide a meaningful and objective assessment of the alternative nuclear fission technology being developed to satisfy the electricity generation requirements of the United States in the period until 2020. The preliminary results in this study consisted primarily of the collection and analysis of massive amounts of data to permit an evaluation of the status of technology for four domestic advanced reactor types. Preliminary assessments of the nature and extent of R and D requirements to ensure viability of these concepts have been undertaken. The report supplies and presents information relating to the extension of the technology assessment and present in a qualitative manner the significant conclusions. Author (GRA)

**N76-14628#** ESB, Inc., Yardley, Pa. Power Technology Dept.
**SODIUM CHLORIDE BATTERY DEVELOPMENT PROGRAM FOR LOAD LEVELING Interim Report, 1 Apr. - 31 Dec. 1974**
J. Werth Jun. 1975 27 p refs
(PB-243872/9; EPRI-RP-109-2-1) Avail: NTIS HC $4.00 CSCL 10C

A sodium chloride cell is presented which consists of a molten sodium negative, a beta alumina solid electrolyte also serving as a separator, and a positive mix containing both molten sodium chloroaluminate and a faradaic additive. The goal of the project was to develop a battery with a manufacturing cost less than 1/3 that of industrial lead-acid batteries and a service and cycle life of at least 10 years. Long life, on the order of 2500 to 5000 deep cycles, is expected since there are no solid-solid transformations in either the negative or positive compartments. Based on the performance of laboratory-scale cells, the overall battery module proposed for load leveling is expected to have a specific energy of at least 45 watt hrs/lb (100 Whr/kg) and possibly more. GRA

**N76-14629#** Federal Energy Administration, Washington, D.C.
**REPORT TO CONGRESS ON ECONOMIC IMPACT OF ENERGY ACTIONS**
Feb. 1975 52 p refs
(PB-243580/8; FEA/B-75/279) Avail: NTIS HC $4.50 CSCL 10A

This report examines the impact of energy shortages on the economy for July 1 to October 10, 1974. Information is presented regarding the impact of energy shortages on employment and the economy. The study examines the evolution of the energy shortage and the impacts, where discernible and measurable, on employment and the general economic situation; it also examines the economic effects of the mandatory petroleum allocation and price regulations. GRA

**N76-14630#** Hawaii State Dept. of Planning and Economic Development, Honolulu.
**STATE POLICY CONSIDERATIONS FOR GEOTHERMAL DEVELOPMENT IN HAWAII**
Eugene M. Grabbe and Robert M. Kamins Apr. 1975 24 p refs Prepared in cooperation with Hawaii Univ.
(Grant NSF ISR-71-03844-A03)
(PB-243467/8; NSF/RA/G-75/014) Avail: NTIS HC $3.50 CSCL 08I

Policy options open to Hawaii in developing its geothermal energy resources are discussed. Topics that are addressed included: uses of the resource; outcomes of exploration and development; constraints on geothermal drilling in Hawaii; state policies toward geothermal drilling and development; and, roles of state and county government in geothermal development. GRA

**N76-14631#** Mitre Corp., McLean, Va.
**ANALYSIS OF STEAM COAL SALES AND PURCHASES**
M. T. Lethi, J. Elliott, D. Ellis, and E. P. Krajeski Apr. 1975 139 p refs
(Contract FEA-C-05-50110-00)
(PB-243575/8; MTR-6878; FEA/G-75/348) Avail: NTIS HC $6.00 CSCL 10A

Specific information on the steam coal market is provided. Investigated are coal purchasing and sales practices, factors influencing coal prices, and current and future contractual relationships between buyers and sellers. Potential problems in

coal use and production and recommendations for solving these problems are identified. GRA

**N76-14632#** Texas Governor's Energy Advisory Council, Austin.
**THE IMPACT OF STATE AND FEDERAL LAW ON DEVELOPMENT OF GEOTHERMAL RESOURCES IN TEXAS Final Report**
Tom Edwards Oct. 1974 56 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243340/7; NSF/RA/N-74-244) Avail: NTIS HC $4.50 CSCL 08I

On the basis of known facts concerning the resource and possible modes of utilizing it, the study attempts to predict how the common law rules of property, the terms of existing mineral leases, state statutes pertaining to state lands, resource production, and the environment, and federal law relating to taxation, the environment, and energy would be applied to geothermal resources and geothermal energy production in Texas. It is suggested that there are some very difficult legal problems to be resolved, but that there are no inseperable legal barriers to development of the resource at this time. On the question of ownership, it is indicated that the resource is most likely to be dealt with under common law rules pertaining to ground water, but that the same general results would follow as under oil and gas law, because the basic legal principles are the same in these areas as in Texas. Author

**N76-14633#** Texas Governor's Energy Advisory Council, Austin.
**ALTERNATIVES FOR THE TEXAS ELECTRIC POWER INDUSTRY Final Report**
H. H. Woodson and C. D. Zinn 15 Oct. 1974 160 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243345/6; NSF/RA/N-74-249) Avail: NTIS HC $6.75 CSCL 10B

Technologies are assessed that may have an impact on the generation and transmission of electric energy for the state of Texas for the time period 1982 to 2000. Topic areas covered include: Light water reactors; High temperature gas cooled reactors; Breeder reactors; Offshore nuclear power plants; Fusion; Molten salt breeder reactor (MSBR); Direct combustion of coal; Gasification of coal; Liquefaction of coal; Gas turbines and combined cycles; Fuel cells; Magnetohydrodynamics and Transmission technologies. GRA

**N76-14634#** Texas Governor's Energy Advisory Council, Austin.
**THE IMPLEMENTATION OF A HYDROGEN ENERGY SYSTEM IN TEXAS Final Report**
C. J. Huang (Houston Univ.) and John R. Howell (Houston Univ.) 15 Dec. 1974 88 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243346/4; NSF/RA/N-74-250) Avail: NTIS HC $5.00 CSCL 10A

Hydrogen production and distribution costs were researched, and the methods best suited to Texas were determined. A gaseous fuel supply/demand model for Texas was developed, based on an existing national natural gas model. This interactive computer model was used to project the price of natural gas scenarios. The ability of hydrogen to compete in such conditions was then examined, and the cost of state subsidies to bring hydrogen to compete in such conditions was then examined, and the cost of state subsidies to bring hydrogen into the market was forecast. GRA

**N76-14635#** Texas Governor's Energy Advisory Council, Austin.
**POTENTIAL FOR SOLID WASTE AS AN ENERGY SOURCE IN TEXAS Final Report**
James E. Halligan (Tex. Tech. Univ.) and William J. Huffman (Tex. Tech. Univ.) Nov. 1974 128 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243351/4; NSF/RA/N-74-255) Avail: NTIS HC $6.00 CSCL 10A

The technology is assessed of solid waste conversion for application to the needs of Texas. The production rate of solid wastes in the municipal, agricultural, and industrial sectors of the state is summarized. Research-development and legislative actions required to implement energy recovery from solid wastes and those locations in Texas where such conservation processes would be feasible are recommended. GRA

**N76-14636#** Texas Governor's Energy Advisory Council, Austin.
**AN ANALYSIS OF THE POTENTIAL USE OF GEOTHERMAL ENERGY FOR POWER GENERATION ALONG THE TEXAS GULF COAST Final Report**
John S. Wilson (Dow Chem. Co.), Burchard P. Shepherd (Dow Chem. Co.), and Sidney Kaufman (Dow Chem. Co.) 15 Oct. 1975 70 p refs
(Grants NSF GI-44085; NSF SIA-73-05812)
(PB-243342/3; NSF/RA/N-74-246) Avail: NTIS HC $4.50 CSCL 08I

The possible potential energy resource represented by deep geopressured waters found along the Texas Gulf Coast are evaluated. The nature and extent of the resource, along with the methods and the economics of power production, are estimated. GRA

**N76-14637#** Spectrolab, Inc., Sylmar, Calif. Energy Conversion Branch.
**ELECTROCHEMICAL IMPREGNATION OF SINTERED NICKEL STRUCTURES WITH CADMIUM USING CONSTANT CURRENT STEP AND ALTERNATING-CURRENT PULSE TECHNIQUES Interim Report, Jan. 1971 - Jun. 1974**
David F. Pickett and Vincent Puglisi Jun. 1975 31 p refs Presented at the Electrochem. Soc. Meeting, 146th, N. Y., 14-17 Oct. 1974
(Contract F33615-75-C-2012; AF Proj. 3145)
(AD-A013931; AFAPL-TR-74-119) Avail: NTIS CSCL 10/3

Cadmium electrodes, made by impregnation of sintered nickel plaques with cadmium hydroxide by three electrochemical techniques followed by formation to cadmium, can be used as efficient electrodes in nickel-cadmium secondary cells yielding capacities as high as 9.8 A-hr/cu in. for aerospace secondary power. In flooded, negative limited cells electrodes made with a constant current step technique retained 80% of the original capacity after 750 cycles at 100% depth of discharge, over a varying temperature range from 21 to 43C. Alternating current pulse techniques, either symmetric or assymetric with respect to time, can yield electrodes with loadings of 2.1 - 2.3 g. of Cd(OH)2 per cubic centimeter of void. These electrodes show promise of being efficient for use in either flooded or starved electrolyte cells. GRA

**N76-14638#** Globe-Union, Inc., El Monte, Calif. Semiconductor Div.
**HARDENED VIOLET RESPONSE SILICON SOLAR CELL FOR SATELLITE APPLICATION Final Report, Jun. 1973 - Apr. 1975**
P. A. Iles May 1975 52 p refs
(Contract F33615-73-C-2073; AF Proj. 3145)
(AD-A013921; AFAPL-TR-75-20) Avail: NTIS CSCL 10/2

This contract involved development of further hardened versions of violet response solar cells, by adding aluminum contacts, and by testing the effects of higher resistivity silicon. The conventional violet cells improved steadily in output during the contract (70-79 mW 2x2 cm). There were difficulties in applying suitable fine line aluminum contacts to the shallow diffused front surface of the cell. The best violet cells with aluminum contacts were about 10% lower in output than the usual violet cells. Radiation tests showed that low resistivity (1-3 ohm-cm) silicon still gave best overall cell performance. Limited environmental tests showed that the performance of violet cells was satisfactory. More intensive study of the overall contact properties is suggested. Violet cells with both conventional and aluminum contacts, and covering a decade of bulk resistivity values, were delivered for evaluation, and for associated tests. GRA

**N76-14639#** American Univ., Washington, D.C.
**RESEARCH ON ELECTROCHEMICAL ENERGY CONVERSION SYSTEMS Interim Progress Report, Apr. - Oct. 1974**
Alayne A. Adams and Robert T. Foley Mar. 1975 31 p refs
(Contract DAAK02-72-C-0084; DA Proj. 1T1-61102-A-34A)
(AD-A014067; IPR-6) Avail: NTIS CSCL 10/2

The research has involved work on two tasks: a search for electrolytes alternative to phosphoric acid for direct and indirect hydrocarbon-air fuel cells, and a study of the corrosion characteristics of electrolytes for intermediate-temperature hydrocarbon-air

fuel cells. The effort during this reporting period has been concentrated on the further investigation of the electrochemical behavior of trifluoromethanesulfonic acid monohydrate as a fuel cell electrolyte. The studies dealt with the use of methanol as a fuel, both from electrooxidation at a platinum electrode and from its tendency to interfere with the air electrode. Methanol dissolved in CF3SO3H.H2O was electrooxidized over a temperature range of 23C to 135C with the highest rate in the neighborhood of 80C. At temperatures above 100C vaporization losses are excessive. Methanol interferes with the air electrode. The electrochemical activities of hydrogen, propane, and air were investigated at a platinum electrode in CF3SO3H.H2O at 23C.
GRA

# 45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

**N76-14640** British Library Lending Div., Boston Spa (England).
**REGULATIONS UNDER THE ATMOSPHERIC POLLUTION LAW OF WEST GERMANY**
28 Aug. 1974 73 p Transl. into ENGLISH from the German (BLL-CE-Trans-6665-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

General provisions governing maintenance of air purity in West Germany are presented. Air pollutants, emissions, and immissions are defined along with units used for measurement. Methods of measurement are described in detail. J.M.S.

**N76-14641** Houston Univ., Tex.
**ENERGY USE AND THE ENVIRONMENT: THE EFFECTS OF ENVIRONMENTAL QUALITY STANDARDS ON THE SUPPLY, DEMAND, AND PRICE OF FOSSIL ENERGY Ph.D. Thesis**
Rodrigo Joseph Lievano 1975 129 p
Avail: Univ. Microfilms Order No. 75-28835

A normative economic model is developed for analyzing the effects of changes in (1) resource availabilities, (2) resource prices, (3) operating environment (e.g., energy and environmental policy), and (4) patterns of energy demand, on the supply, demand, and price of fossil energy resources. The model is developed by interfacing (1) a normative economic model of oil and natural gas supply, and (2) an econometric demand model for the important fossil fuels and electricity, through a linear programming model of the energy conversion industries. This interface utilizes the economic theories of resource allocation and valuation, and of competive markets and economic equilibrium. The model is used to evaluate the effects of currently announced limitations on waste discharges to the water and air by industrial sources on the supply, demand, and price of fossil energy resources. Results are presented and discussed. Dissert. Abstr.

**N76-14642** California Univ., Los Angeles.
**A CRITICAL ASSESSMENT OF THE ROLE OF COMPUTER MODELS IN AIR QUALITY PLANNING AND DECISION-MAKING Ph.D. Thesis**
Ronald Yutaka Wada 1975 193 p
Avail: Univ. Microfilms Order No. 75-27003

The relationship between pollutant emissions and ambient air quality is examined. Modeling efforts are assessed in terms of their potential for use in the continuing air quality implementation planning process. The general theory upon which most of the models developed are based is reviewed, along with each sub-component of the general modeling framework. Likely sources of error and their potential magnitudes are identified. Quantitative evaluations of model performance are reviewed. These studies indicate essentially that a factor of two error is a good rule of thumb for describing the accuracy of available models, regardless of the approach used. Alternative criteria for evaluation of the utility of the various models are presented based on (1) the margin of safety built into each air quality standard, and (2) control cost considerations. Dissert. Abstr.

**N76-14643** Washington Univ., Seattle.
**CONTROL OF TRACE AIR POLLUTANT VAPORS BY CONDENSATION Ph.D. Thesis**
William Gene Tucker 1975 160 p
Avail: Univ. Microfilms Order No. 75-28452

An approach was developed for the design of surface condensers to remove trace concentration, high-boiling point pollutant vapors from industrial stack gases. Of particular interest was the inexpensive control of visible plumes of condensation aerosol created by stack gases containing vapor mixtures with total concentrations on the order of one hundred parts per million. The approach utilizes design calculations that consider both heat and mass transfer. The approach also involves field testing of the stack gas to obtain data on vapor-liquid equilibria. Vapor-condensate equilibrium data are essential for selecting the condenser surface temperature that will promote high mass transfer rates with as little sensible cooling of the stack gas as possible. A method for obtaining approximate vapor-condensate equilibrium data from stack gases by a pollutant vapor dew point technique was developed and field tested. The design approach is illustrated for a plywood veneer dryer stack gas. Dissert. Abstr.

**N76-14644** Washington Univ., Seattle.
**A SYSTEMATIC APPROACH FOR COMPUTER ANALYSIS OF AIR CHEMISTRY DATA Ph.D. Thesis**
Alvin Henry Vanderpol 1975 121 p
Avail: Univ. Microfilms Order No. 75-28457

Computerized collection, storage, and analysis of large quantities of multivariate data from atmospheric chemistry and aerosol characterization experiments is investigated. The purpose is development and implementation of computer programs for analysis of the complete data base with minimal constraints. An overall scheme for collection, storage, and analysis of the variety of data for several aerosol instruments is established. Programs are included for initial examination of the data base. Interactive graphics techniques are adapted to permit the noncomputer expert to view, edit, present, and operate on x, y, t plots. Development of a computerized system to automatically characterize, sort through, and recognize significant relationships within existing data bases is described. The usual a priori scientific approach is integrated with statistical and pattern recognition techniques to allow discovery of unsuspected relationships. Dissert. Abstr.

**N76-14645** Minnesota Univ., Minneapolis.
**AEROSOL SAMPLING AND TRANSPORT Ph.D. Thesis**
Jugal Kishore Agarwal 1975 191 p
Avail: Univ. Microfilms Order No. 75-27127

The mechanics of aerosol sampling and transport is studied with a view towards developing rational criteria for designing efficient sampling and transport systems. The problem of aerosol sampling under calm air conditions was studied by solving the Navier-Stokes equation numerically on a computer to determine the flow field around the inlet. The particle trajectory was then calculated by integrating the equations of motion. The trajectory calculations took into account both the inertial effect of the particle and the finite particle settling velocity under gravity. The result indicates that the sampling efficiency of an inlet depends primarily on two dimensionless parameters, viz., the Stokes number and the relative settling velocity, and the third dimensionless parameter, the Reynolds number, has only a minor effect. It is shown that the classical sampling criteria developed by Davies are too stringent and that representative samples can often be obtained when Davies criteria are not met. Dissert. Abstr.

**N76-14646*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**ELEMENTAL COMPOSITION AND SIZE DISTRIBUTION OF PARTICULATES IN CLEVELAND, OHIO**
Harold E. Leibecki, Robert B. King, J. Stuart Fordyce, and Harold E. Neustadter 31 Oct. 1975 51 p refs Presented at the Intern. Conf. on Heavy Metals in the Environ., Toronto, Ont., Can., 27-31 Oct. 1975
(NASA-TM-X-71839) Avail: NTIS HC $4.50 CSCL 13B

Measurements were made of the elemental particle size distribution at five contrasting urban environments with different source-type distributions in Cleveland, Ohio. Air quality conditions ranged from normal to air pollution alert levels. A parallel network of high-volume cascade impactors (5-state) were used for simultaneous sampling on glass fiber surfaces for mass

determinations and on Whatman-41 surfaces for elemental analysis by neutron activation for 25 elements. The elemental data are assessed in terms of distribution functions and interrelationships and are compared between locations as a function of resultant wind direction in an attempt to relate the findings to sources. Author

**N76-14647*#** Stanford Research Inst., Menlo Park, Calif.
**A PRELIMINARY STUDY OF AIR-POLLUTION MEASUREMENT BY ACTIVE REMOTE-SENSING TECHNIQUES Final Report**
M. L. Wright, E. K. Proctor, L. S. Gasiorek, and E. M. Liston Jun. 1975 341 p refs
(Contract NAS1-11657; SRI Proj. 1966)
(NASA-CR-132724) Avail: NTIS HC $10.00 CSCL 13B

Air pollutants are identified, and the needs for their measurement from satellites and aircraft are discussed. An assessment is made of the properties of these pollutants and of the normal atmosphere, including interactions with light of various wavelengths and the resulting effects on transmission and scattering of optical signals. The possible methods for active remote measurement are described; the relative performance capabilities of double-ended and single-ended systems are compared qualitatively; and the capabilities of the several single-ended or backscattering techniques are compared quantitatively. The differential-absorption lidar (DIAL) technique is shown to be superior to the other backscattering techniques. The lidar system parameters and their relationships to the environmental factors and the properties of pollutants are examined in detail. A computer program that models both the atmosphere (including pollutants) and the lidar system is described. The performance capabilities of present and future lidar components are assessed, and projections are made of prospective measurement capabilities for future lidar systems. Following a discussion of some important operational factors that affect both the design and measurement capabilities of airborne and satellite-based lidar systems, the extensive analytical results obtained through more than 1000 individual cases analyzed with the aid of the computer program are summarized and discussed. The conclusions are presented. Recommendations are also made for additional studies to investigate cases that could not be explored adequately during this study. Author

**N76-14648#** Washington Univ., St. Louis, Mo. Center for Development Technology.
**A STATE OF THE ART REVIEW OF THE EFFECTS OF REGULATION ON TECHNOLOGICAL INNOVATION IN THE CHEMICAL AND ALLIED PRODUCTS INDUSTRIES 'CAPI PROJECT'. VOLUME 3: ABSTRACTS AND LITERATURE LIST Final Report**
Christopher J. Hill Feb. 1975 249 p
(Grant NSF RDA-74-20086)
(PB-243729/1; NSF/RDA-74/5/3) Avail: NTIS HC $8.00; HC also available from NTIS in set of 3 reports $16.00/SET as PB-243726-SET CSCL 07A

These citations concern the research to review and evaluate the state of understanding of the impact of regulations on technological innovation. GRA

**N76-14649#** National Oceanic and Atmospheric Administration, Silver Spring, Md. Air Resources Labs.
**A REGIONAL-CONTINENTAL SCALE TRANSPORT, DIFFUSION, AND DEPOSITION MODEL. PART 1: TRAJECTORY MODEL PART 2: DIFFUSION-DEPOSITION MODELS**
Jerome L. Heffter, Albion D. Taylor, and Gilbert J. Ferber Jun. 1975 34 p refs
(COM-75-11094/0; NOAA-TM-ERL-ARL-50-Pt-1/2; NOAA-75072306-Pt-1/2) Avail: NTIS HC $4.00 CSCL 13B

A computerized postfacto trajectory model for calculating the transport, diffusion, and deposition of effluents on regional and continental scales. A month, season, or year of trajectories at 6-hourly time intervals is calculated forward or backward in time from any origin in the Northern Hemisphere for durations up to 10 days. Trajectory computations use winds at any altitude above sea level or winds averaged through any desired layer above average terrain. A Gaussian plume model is combined with the trajectory model to calculate long-term mean ground-level air concentrations and deposition amounts. GRA

**N76-14650#** Midwest Research Inst., Kansas City, Mo.
**SURVEY OF INDUSTRIAL PROCESSING DATA. TASK 2: POLLUTION POTENTIAL OF POLYBROMINATED BIPHENYLS Final Report, Dec. 1974 - Jun. 1975**
Charles E. Mumma and Dennis D. Wallace Jun. 1975 57 p refs
(Contract EPA-68-01-2105)
(PB-243690/5; EPA-560/3-75-004) Avail: NTIS HC $4.50 CSCL 07A

The potential for environmental contamination by brominated biphenyls is evaluated. The information collection and evaluation activities were designed to identify sources of brominated biphenyls and the environmental and health effects of these substances. Topics discussed include: identification and evaluation of production sites and volumes, manufacturing processes and waste disposal practices, commercial uses and substitutes for products and environmental and health aspects. GRA

**N76-14651#** Naval Ship Research and Development Center, Bethesda, Md. Materials Dept.
**DETERMINING THE CONCENTRATION OF OIL IN WATER SAMPLES BY INFRARED SPECTROMETRY. PHASE 2: INTERLABORATORY STUDY, VOLUME 1 Evaluation Report**
Stanley Finger, Harry Feingold, Ed Timko, and Sidney Orbach Jan. 1975 124 p refs
(SF57572701)
(AD-A011041; NSRDC-4536-Vol-1) Avail: NTIS CSCL 07/4

The main objective of this interlaboratory study is to validate and develop confidence in the quantitative analysis of oil-in-water concentration based on solvent extraction and infrared spectrophotometry. It is desired to evaluate this analytical procedure as a function of oil type, water salinity, oil concentration. A further objective of this study is to determine the range of variations of the measurement errors associated with this method both within each individual laboratory as well as across the participating laboratories. This volume highlights results and conclusions. Data are included. GRA

**N76-14652#** Naval Ship Research and Development Center, Bethesda, Md. Material Dept.
**DETERMINING THE CONCENTRATION OF OIL IN WATER SAMPLES BY INFRARED SPECTROPHOTOMETRY. PHASE 2: INTERLABORATORY STUDY, VOLUME 2 Evaluation Report**
Stanley Finger, Harry Feingold, Ed Timko, and Sidney Orbach Jan. 1975 100 p refs
(SF57572701)
(AD-A011042; NSRDC-4536-Vol-2) Avail: NTIS CSCL 07/4

An interlaboratory study to validate a method for measuring the concentration of oil in water was conducted with the active participation of seven laboratories. This volume (Volume II) contains discussions and derivations of some of the procedures in the statistical analysis used in this study, results at a greater level of detail, and results based on the inclusion of sample aging as well as calibration corrections. The effect of these two corrections were studied by generating two additional sets of modified data which incorporate the corrections and repeating many of the analyses performed with the original data set. The calibration correction is based on fitting an inverse linear least squares regression line to the calibration data and generating a revised second set of laboratory reported concentrations using this calibration curve. The aging corrections are based on the results of the Sample Aging Study in Phase I of this effort. GRA

**N76-14653#** Naval Ship Research and Development Center, Bethesda, Md. Materials Dept.
**DETERMINING THE CONCENTRATION OF OIL IN WATER SAMPLES BY INFRARED SPECTROPHOTOMETRY. PHASE 2: INTERLABORATORY STUDY, VOLUME 3 Evaluation Report**
Stanley Finger, Harry Feingold, Ed Timko, and Sidney Orbach Jan. 1975 177 p
(SF57572701)
(AD-A011043; NSRDC-4536-Vol-3) Avail: NTIS CSCL 07/4

An interlaboratory study to validate a method for measuring the concentration of oil in water was conducted with the active

participation of seven laboratories. This volume contains appendices presenting a description of samples shipped to laboratories participating in the interlaboratory study of the IR Oil Concentration Analysis Method, and data provided by laboratories participating in the interlaboratory study of the IR Oil Concentration Analysis Method. GRA

**N76-14654#** National Environmental Research Center, Research Triangle Park, N.C. Chemistry and Physics Lab.
**AMBIENT AIR MEASUREMENTS OF VINYL CHLORIDE IN THE NIAGARA FALLS AREA Environmental Monitoring Series**
Bruce W. Gay, Jr. and Richard C. Noonan May 1975 19 p refs
(PB-243695/4; EPA-650/4-75-020) Avail: NTIS HC $3.50 CSCL 13B

A 6-day survey was conducted in the Niagara Falls area to determine the concentration of vinyl chloride in the atmosphere. Samples were obtained in a residential area adjacent to the chemical plants where vinyl chloride emissions were suspected, in areas around the plants, and in other areas of Niagara Falls. The highest concentration of vinyl chloride measured was 40 ppb for a 5-hour integrated sample observed at a residential area two blocks east of a vinyl chloride polymerization plant. Grab samples taken downwind of chemical plants exhibited a high of 28 ppb. Samples taken from downtown Niagara Falls and upwind north of the chemical plants contained no detectable vinyl chloride. The areas surrounding the chemical plants, including the adjacent residential areas, are also affected by emissions into the atmosphere of chlorine and other halogenated compounds as exhibited by the deterioration of metal surfaces, particularly aluminum windows and doors. GRA

**N76-14655#** California Univ., Santa Barbara. Marine Science Inst.
**OIL SPILL AND OIL POLLUTION REPORTS, FEBRUARY 1975 - APRIL 1975 Quarterly Report**
Floyd A. Jr. DeWitt and Penelope Melvin Jun. 1975 248 p
(Grant EPA-R-803063)
(PB-243724/2; EPA-670/2-75-059) Avail: NTIS HC $8.00; HC also available from SOD CSCL 13B

A quarterly compilation of oil spill events and oil pollution report summaries are presented. Included in the report are: summaries of oil spill events; summaries and bibliographic literature citations; summaries of current research projects; and patent summaries. GRA

**N76-14656#** Maine Univ., Orono.
**PHOTOCHEMICAL OXIDATION OF KRAFT AIR POLLUTANTS Final Report**
Michael D. Bentley May 1975 17 p refs
(Grant EPA-R-800209)
(PB-243599/8; EPA-650/3-75-005) Avail: NTIS HC $3.50 CSCL 07E

The photolyses of methyl mercaptan, dimethyl disulfide, and methylmethanethiolsulfonate were studied. The photolysis of methyl mercaptan in air was shown to yield dimethyl disulfide, methansulfonic acid, ethyl mercaptan, methanol, formic acid, methane, sulfur trioxide, and sulfur dioxide. The photolysis of dimethyldisulfide in air was shown to yield methanesulfonic acid, methylmethanethiolsulfonate, methanesulfinic acid, methyl formate, sulfur, sulfur dioxide, and sulfur trioxide. The photolysis of methylmethanethiolsulfonate in tetrahydrofuran resulted in formation of methane, methyl mercaptan, dimethyl sulfide, dimethyldisulfide, methanesulfinic acid, methanesulfonic acid, and sulfur dioxide. GRA

**N76-14657#** Environmental Protection Agency, Washington, D.C. Office of Research and Development.
**PROJECTS IN THE INDUSTRIAL POLLUTION CONTROL DIVISION: DECEMBER 1974 Environmental Protection Technology Series**
Mar. 1975 449 p refs
(PB-243892/7; EPA-600/2-75-001) Avail: NTIS HC $11.75 CSCL 13B

The document is a compilation of information sheets from industrial pollution control projects initiated since fiscal year 1967 through fiscal year 1974. Each sheet contains the objectives, statistical information, and a brief description of the particular project. General introductory information on the Federal industrial pollution control program is also presented to provide perspective on the magnitude of industrial pollution and the research directions that must be pursued in order to develop the technology to adequately control this largest point source of pollution in the United States. GRA

**N76-14658#** Environmental Protection Agency, Washington, D.C. Oil and Special Materials Control Div.
**OIL AND HAZARDOUS MATERIALS SPILL INFORMATION RETRIEVAL SYSTEM. USER'S MANUAL. (OHM-SIRS)**
Apr. 1975 17 p
(PB-243662/4; EPA/DF-75/001A) Avail: NTIS HC $3.50 CSCL 13B

Guidance is given to those who prepare reports on spill episodes to the Division of Oil and Special Materials Control, and who expect to access the system for developing Regional analytical studies. The increasing number of spills reports and the need for more accurate statistical analysis of episodes make it imperative that regions report promptly and in accordance with this manual in order that data are available to the Congress, EPA top management, the Office of Management and Budget, and the public. GRA

**N76-14659#** Amoco Oil Co., Naperville, Ill. Research and Development Dept.
**DEMONSTRATION OF REDUCED HYDROCARBON EMISSIONS FROM GASOLINE LOADING TERMINALS**
D. C. Walker, H. W. Husa, and I. Ginsburgh Jun. 1975 55 p
(Contract EPA-68-02-1314)
(PB-243363/9; EPA-650/2-75-042) Avail: NTIS HC $4.50 CSCL 13B

The report gives results of test work to demonstrate the effectiveness of hydrocarbon oxidation for reducing emissions from a gasoline truck loading terminal in Philadelphia that pumps about 2 million barrels of gasoline per year. Major objectives of the program were to determine control efficiency, to observe operational characteristics, and to compare this installation with other known systems. Tests run during each of the four seasons showed that the oxidizer safely and efficiency disposes of 99+ percent of the vapor it receives, even in extremely cold weather when the air-gasoline vapor mixture is in flammable range. Initially, a large portion of the vapor from the trucks was not reaching the oxidizer, primarily because of blockage caused by liquid carryover to the vapor collection system. After this was corrected, collection and disposal of the vapor exceeded 90 percent. High efficiency and low flame temperatures of the oxidizer limit formation of emissions. GRA

**N76-14660#** Battelle Pacific Northwest Labs., Richland, Wash.
**LOGISTIC REQUIREMENTS AND CAPABILITIES FOR RESPONSE TO OIL POLLUTION IN ALASKA Final Report**
P. L. Peterson, M. M. Orgill, W. H. Swift, and W. V. Loscutoff
Mar. 1975 375 p refs
(Contract DOT-CG-23223-A)
(AD-A014044; USCG-D-097-75) Avail: NTIS CSCL 13/2

The report identifies present and projected logistic support requirements for response to oil spills in the arctic and sub-arctic regions of Alaska. Area response is based on estimates of the most probable course of petroleum development within the state. The present logistic support capability of the U.S. Coast Guard, military organizations, other federal agencies and private industry is identified and compared to future response requirements. A set of guidelines was used to assess the response requirements in various environmental settings (moving pack ice, open water, tundra, etc.). The guidelines included the number of personnel and amount of equipment to be transported, time on scene, and initial response time. Fourteen selected sites were evaluated. GRA

**N76-14661#** Southern Illinois Univ., Carbondale. Dept. of Geography.
**AN EVALUATION OF WATER REUSE FOR MUNICIPAL SUPPLY**
Daniel Dworkin (Bulter, Univ., Indianapolis) and Duanne D. Baumann Dec. 1974 278 p refs
(Contract DACW43-73-C-0013)

(AD-A005053; IWR-CR-74-11) Avail: NTIS CSCL 13/2

Reuse can be an alternative source of water for municipal water supply systems. While the demand for water continues to increase in the United States, especially in our burgeoning urban areas, the traditional alternatives for water supply planning, while useful in the past, are either inappropriate today or may no longer be practicable. Recycling renovated waste water has been shown, under specific qualifications, to be a socially acceptable and economically efficient alternative for municipal water supply planning. Two problems may be related to the low community adoption of water reuse: the unavailability of a methodology to access the relative value of reuse and the professional biases of consulting engineers and public health officials. In this report a simulation model for evaluating the economic efficiency of water reuse is formulated and applied to a single community and the nature and role of professional bias in the decision making process in water reuse planning is described. GRA

**N76-14662#** Foster-Miller Associates, Inc., Waltham, Mass.

**DEVELOPMENT OF A CENTRIFUGAL SYSTEM FOR SEPARATION OF OIL AND SOLIDS FROM SHIPBOARD Final Report**

A. R. Guzdar, A. C. Harvey, J. Potter, and W. M. Mack Jul. 1975 110 p refs

(Contract DOT-CG-24287-A)

(AD-A014045; USCG-D-118-75) Avail: NTIS CSCL 13/2

Initial design and laboratory testing of an oil-solids-water separating system is described. The system is intended to process ships' bilge water at a rate of 50 gpm and provide water effluent containing less than 15 ppm of oil. The primary components of the final design are: (1) a cleanable bag strainer to retain coarse and fibrous solids, (2) a centrifugal pump that also separates settleable solids, (3) a coalescing centrifuge that separates well-dispersed oil, and (4) an oil-water monitor that continuously measures and records the oil-in-water concentration of the effluent. Results of component testing indicates that the overall system is capable of processing 50 gpm of bilge water containing concentration of up to 10 percent No. 2 fuel or lube oil and discharging water effluent with 15 ppm or less of oil. The following elements of this system design are described in detail: (1) the test evaluation of the Fram-Akers primary separator; (2) the development and testing of the FMA Solids-Oil-Separating Pump; (3) the evaluation of the laboratory model FMA Centrifugal Coalescer; (4) the development and testing of the FMA Shipboard Centrifugal Coalescer; and (5) the synthesis of the Shipboard Separator System. GRA

**N76-14663#** Argonne National Lab., Ill.

**AIR QUALITY ASSESSMENT MODEL (AQAM) FIELD DATA COLLECTION GUIDE Final Report, 1 Jun. 1974 - 15 Jul. 1975**

Bernard Todd Delaney Aug. 1975 173 p refs Sponsored by AF

(AD-A013773; AFWL-TR-75-220) Avail: NTIS CSCL 13/2

This guide is designed to provide a detailed procedure for obtaining input data for the United States Air Force/Argonne National Laboratory Air Quality Assessment Model (AQAM). AQAM is a computer model developed to assess the impact of Air Force operations on surrounding air quality. The quide describes precisely what data are required, where the data can be obtained, and how the raw data are reduced to usable form. These reduced data are used in AQAM to produce an accurate pollution emission inventory. A section detailing use of the gathered data for hand calculations is also included. GRA

**N76-14664#** Syracuse Univ. Research Corp., N.Y. Life Science Div.

**REVIEW AND EVALUATION OF AVAILABLE TECHNIQUES FOR DETERMINING PERSISTENCE AND ROUTES OF DEGRADATION OF CHEMICAL SUBSTANCES IN THE ENVIRONMENT Final Technical Report**

P. H. Howard, J. Saxena, P. R. Durkin, and L. T. Ou May 1975 560 p refs

(Contract EPA-68-01-2210)

(PB-243825/7; SURC-TR-74-577; EPA-560/5-75-006) Avail: NTIS HC $13.50 CSCL 06F

This report reviews and evaluates the present state of techniques which have been used to determine the environmental persistence (biological, chemical and photochemical degradation) and routes of degradation of chemicals released in the environment by human activities. The techniques that were identified were reviewed and then evaluated for their ability to simulate natural environmental conditions, convenience of procedure, time requirements, necessary equipment and reproducibility. The ultimate evaluation was based on how well the methods have worked with well-known environmental contaminants. A cost analysis of the test methods was undertaken to determine the feasibility of comprehensive screening of chemicals for environmental persistence. A relationship between chemical structure and environmental persistence is presented and some theoretical grounds for such correlations are discussed. An attempt has been made to categorize chemicals for their suitability to various test methods based on consideration of physiochemical properties, toxicity, environmental release factors and commercial economic factors. GRA

# 46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

**N76-14665** Cornell Univ., Ithaca, N.Y.

**CLIMATIC CHANGE ON THE EARTH AND MARS Ph.D. Thesis**

Owen Brian Toon 1975 413 p

Avail: Univ. Microfilms Order No. 75-27871

Stratospheric aerosols produced by volcanic explosions and by the exhaust from Space Shuttles, Supersonic Transports and other high flying aircraft may have significant effects on the earth's climate. To evaluate the climatic effects of these aerosols a radiative-convective model of the earth's global mean temperature was developed. Two examples of climatic change on Mars are examined. Infrared spectra of the dust composing the global Martian dust storm of 1971 were studied to find the dust composition and size distribution. The implications for Martian meteorology and geology are discussed. The use of infrared spectra to determine the properties of aerosol particles is critically examined. Also, a large scale climatic change on Mars was studied using a simple model of the Martian climate. It is found that tremendous changes in the atmospheric pressure may occur if enough CO2 is available in the Martian polar caps. The empirical evidence for climatic change on Mars was evaluated using the model of climate. Dissert. Abstr.

**N76-14666** Utah Univ., Salt Lake City.

**ON STRONGLY DIVERGENT FLOWS OF THE UPPER ATMOSPHERE Ph.D. Thesis**

Alexander Edward MacDonald 1975 199 p

Avail: Univ. Microfilms Order No. 75-28875

A kinematic steady state characterized by substantial divergence and vanishing absolute vorticity is studied numerically by the use of simple models and observationally with objectively analyzed data. It was found that the value of the steady state divergence is determined mainly by the rate of heating. It is suggested that when the Laplacian of synoptic scale heating is less than zero, the atmosphere will always evolve toward the divergent and irrotational (with respect to space) steady state; when heating is absent, a steady state of substantial absolute vorticity and vanishing divergence is approached. A vertical motion adjustment model is found to predict the relationship between the surface precipitation rate and the upper level divergence in good agreement with observations for areas of wet convection. Case studies are described which indicate the divergent steady state is fairly common in the upper troposphere during the subtropical summer; it is generally associated with heavy wet convection. Dissert. Abstr.

**N76-14667** Maryland Univ., College Park.

**RELATIVISTIC ELECTRON PRECIPITATION IN THE AURORAL ZONE Ph.D. Thesis**

David Jay Simons 1975 199 p

Avail: Univ. Microfilms Order No. 75-29132

The energy spectra and pitch angle distributions of electrons in the energy range 50 keV to 2 MeV were determined by a solid state electron energy spectrometer during the relativistic electron precipitation (REP) event of 31 May 1972. The experiment was carried aboard a Nike-Cajun sounding rocket as component of a joint American-Norwegian (NASA-NDRE) ionospheric investigation. The design and theoretical modeling of the instrument is described. The extensive preflight calibrations on the NASA-Goddard 2 MeV Van de Graaff electron-proton accelerator are compared with the theoretical model. The electron pitch angle distributions are determined from a knowledge of the rocket aspect and the direction in space of the earth's magnetic field. The rocket aspect determination is treated in depth and a method is developed to compensate for the malfunctioning of the aspect magnetometer. Dissert. Abstr.

**N76-14668** Colorado State Univ., Fort Collins.
**AN INVESTIGATION OF TURBULENT TRANSPORT IN THE EXTREME LOWER ATMOSPHERE Ph.D. Thesis**
Chester Arthur Koper, Jr. 1975 210 p
Avail: Univ. Microfilms Order No. 75-26407

A model in which the Lagrangian turbulent velocity autocorrelation is expressed by a domain integral over a set of usual Eulerian autocorrelations is developed along with a method for ascertaining the statistical stationarity of turbulent velocity by creating an equivalent ensemble which approximates the real ensemble of turbulent velocity realizations. An experimental investigation of the flow in the extreme lower atmospheric layer, i.e., the layer up to about 5 m depth, is conducted. This flow is both dynamically and thermally simulated satisfactorily using the wake flow generated by a 3.04 m diameter fan installed at a field site located on flat grassland. Simultaneous measurements of turbulent velocity at five stations on a turbulence line along the wake axis are carried out under calm wind, dry, and stable conditions utilizing a longitudinal array of five hot-wire anemometers remotely operated. Dissert. Abstr.

**N76-14669** Yale Univ., New Haven, Conn.
**ION VELOCITY DISTRIBUTIONS IN THE AURORAL IONOSPHERE Ph.D. Thesis**
Jean-Pierre St.-Maurice 1975 250 p
Avail: Univ. Microfilms Order No. 75-27109

Using a relaxation model of collisions Boltzman's equation was solved for ion velocity distributions in the ionosphere. It was found that for infrequent collisions and strong electric fields the ions are distributed over a torus in velocity space. As the collision frequency is increased the ions distribute themselves on a portion of this torus. Similar distributions are expected for other models of ion-neutral interactions which may be physically more accurate than a relaxation model. In particular, resonant charge exchange reactions, which are dominant for O(+) above 200 km, drive the ions to the same kind of non-Maxwellian distribution. A comparison with results obtained with a polarization model for collisions in the limit of small departures from a Maxwellian also shows our description to be qualitatively correct. Dissert. Abstr.

**N76-14670** Utah Univ., Salt Lake City.
**INTERPRETATION OF ELECTROMAGNETIC FIELD MEASUREMENTS Ph.D. Thesis**
Bruce Dyfrig Smith 1975 258 p
Avail: Univ. Microfilms Order No. 75-26048

New applications and theoretical methods for the interpretation of electromagnetic field measurements are introduced. The analogy between transmission line equations and basic equations governing electromagnetic field behavior is first discussed. A new approach to the derivation of this analogy is based upon the Schelkunoff vector and wave potentials. A quantitative evaluation of sounding measurements made from vertical magnetic dipole sources is then made. The principles of the quantitative evaluation are based upon statistical methods derived from the formulation of the generalized least square inversion problem. The computation of magnetic field polarization ellipse parameters is also considered. A new definition of ellipticity is given where the ellipticity changes sign depending upon the sign of the phase difference between the vertical and horizontal magnetic field components. Analysis of polarization ellipse parameters determined from the inversion of tilt angle and ellipticity data taken from two different sounding sites is also discussed. Dissert. Abstr.

**N76-14671** Saint Louis Univ., Mo.
**SURFACE WAVE GENERATION BY CENTRAL UNITED STATES EARTHQUAKES Ph.D. Thesis**
Robert Bernard Herrmann 1974 274 p
Avail: Univ. Microfilms Order No. 75-26264

Using the P wave first motions and the surface wave amplitude spectra of ten earthquakes in the central United States, the focal mechanism, focal depth, and seismic moment were determined for each event. Normal faulting, reverse faulting, and strike slip faulting on approximately vertical fault planes were all found to occur in the region containing the states of Illinois, Missouri, Kentucky, Arkansas, Tennessee, and Mississippi. Dissert. Abstr.

**N76-14672** Columbia Univ., New York.
**A COMPREHENSIVE STUDY OF LONG PERIOD (20-200 sec) EARTH NOISE AT THE HIGH GAIN WORLD WIDE SEISMOGRAPH STATIONS Ph.D. Thesis**
Andrew Joseph Murphy 1975 146 p
Avail: Univ. Microfilms Order No. 75-27447

The characteristics of long-period earth noise have been investigated at the 11 high-gain, long-period (HGLP) seismograph stations using as many as three years of analog seismograms and digital data from these stations. The level of earth noise recorded by horizontal component seismographs at HGLP stations, however, is shown to be dependent on local meteorological conditions. This dependency decreases with increasing depth of overburden. The tilt motions recorded by horizontal seismographs are discussed. It is shown that the signal-to-noise ratio on horizontal seismographs can be significantly improved by burial at depth of several hundred meters which removes the major portion of the tilt noise associated with low velocity winds, but the signal-to-noise on the vertical and horizontal seismographs cannot be further improved without going to impractical depths of burial (more than two or three km). Dissert. Abstr.

**N76-14673** California Univ., Los Angeles.
**ANISOTROPY OF THE UPPER MANTLE OF THE PACIFIC BASIN Ph.D. Thesis**
John William Schlue 1975 141 p
Avail: Univ. Microfilms Order No. 75-26988

Fundamental-mode Love-wave phase velocities were studied for 12 single-station paths across the Pacific Basin. The phase velocities showed a dependence on position within the Pacific Basin, with a systematic increase in phase velocities with distance from the East Pacific Rise. The errors from Love-wave higher-mode interference were not as large as expected. The data were inverted using the model of Leeds et al., (1974) as a starting structure. The results of the inversions indicated an isotropic shear velocity of beta = 4.60 km/sec in the lithosphere, and anisotropic shear velocities beta SV = 4.11 km/sec and beta SH = 4.25 km/sec in the asthenosphere. The values for beta SV were obtained by inversion of the Rayleigh-wave data obtained by Leeds (1973). Inversions were also made in a test for azimuthal anisotropy, but all variations were well within the estimated noise of the data. Dissert. Abstr.

**N76-14674** Washington Univ., Seattle.
**AN EXPERIMENTAL INVESTIGATION OF THE BOUNDARY LAYER UNDER PACK ICE Ph.D. Thesis**
Miles Gordon McPhee 1974 174 p
Avail: Univ. Microfilms Order No. 75-28400

Measurements of the mean and turbulent flow structure under pack ice were made during the 1972 AIDJEX Pilot Study with small mechanical current meter triplets on three separate masts at several depths throughout the entire rotational boundary layer. The analog between the ice-ocean boundary layer and the surface-atmospheric boundary layer was explored in detail with composite averages of measured Reynolds stress and mean flow compared to predictions of recent atmospheric models. The most significant measurements were made during periods of maximum steady ice drift during a storm. Density structure, measured with a CTD probe, showed a well-mixed layer of near neutral stability extending to about 35 m bounded below by a strongly stable pycnocline. This depth corresponded closely to the depth

of frictional influence observed during the peak wind period, as indicated by turning of the velocity vector, and from consideration of the turbulent energy profile. Dissert. Abstr.

**N76-14675*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**HOT, COLD, AND ANNUAL REFERENCE ATMOSPHERES FOR EDWARDS AIR FORCE BASE, CALIFORNIA (1975 VERSION)**
D. L. Johnson Nov. 1975 111 p refs Supersedes NASA-TM-X-64941
(NASA-TM-X-64970) Avail: NTIS HC $5.50 CSCL 04A

Reference atmospheres pertaining to summer (hot), winter (cold), and mean annual conditions for Edwards Air Force Base, California, are presented from surface to 90 km altitude (700 km for the annual model). Computed values of pressure, kinetic temperature, virtual temperature, and density and relative differences [percentage departure from the Edwards reference atmosphers, 1975 (ERA-75)] of the atmospheric parameters versus altitude are tabulated in 250 m increments. Hydrostatic and gas law equations were used in conjunction with radiosonde and rocketsonde thermodynamic data in determining the vertical structure of these atmospheric models. The thermodynamic parameters were all subjected to a fifth degree least-squares curve-fit procedure, and the resulting coefficients were incorporated into Univac 1108 computer subroutines so that any quantity may be recomputed at any desired altitude using these subroutines. Author

**N76-14676#** Weapons Research Establishment, Salisbury (Australia).
**MEASUREMENT OF ATOMIC HYDROGEN AND MOLECULAR OXYGEN DENSITIES IN THE NIGHT-TIME ATMOSPHERE**
G. G. OConnor Apr. 1975 16 p refs
(WRE-TN-1361(WR/D)) Avail: NTIS HC $3.50

Measurements of Lyman alpha night airglow made with rocket borne ionization chambers were used to derive the atomic hydrogen and molecular oxygen density profiles between 70 and 120 km altitude. The measured profiles are compared with photochemical model and standard atmosphere density profiles respectively. Author

**N76-14677#** Research Inst. of National Defence, Stockholm (Sweden).
**SEISMIC EVENT IDENTIFICATION BY NEGATIVE EVIDENCE**
Eva Elvers Feb. 1974 34 p refs
(FOA-4-C-4564-A1) Avail: NTIS HC $4.00

A decision-theoretical model for seismic discrimination between earthquake and underground nuclear explosions is developed. The influence of long and short period detection thresholds on the probabilities to identify explosions and to make false alarms is discussed. The model includes identification by negative evidence. This kind of identification is considered in the case when only short period data are available and when the longperiod signal amplitude is supposed to be less than or equal to the seismic noise amplitude. For one set of data - obtained from North American events at the Hagfors Observatory in Sweden - the applicability of the m(M) method is increased about half a magnitude by including identification by negative evidence. Author

**N76-14678*#** Old Dominion Univ. Research Foundation, Norfolk, Va.
**PERFORMANCE TESTS ON THE KOHMYR ECC OZONE SONDE Final Technical Report, 1 Feb. - 31 Dec. 1975**
A. R. Bandy and A. L. Torres (Sci. Pump Corp.) Oct. 1975 12 p refs
(Grant NsG-6002)
Avail: NTIS HC $3.50 CSCL 04A

The reliability and accuracy of the Kohmyr ECC ozone sonde are determined. Emphasis is placed on establishing and testing for leak-free connections and stable pump flow rates as well as properly adjusting the pumping pressure. Calibration of the Kohmyr ECC ozone sondes and Dasibi monitors is described. Raw ordinate data and ozone connection data are presented in tabular form. The results of a linear regression treatment of the sonde-indicated ozone concentration vs. Dasibi readings for each switch position are included along with averages of the regression parameters over the six sequencing switch positions. It is suggested that sondes and Dasibi monitors be individually calibrated before flight. J.M.S.

**N76-14679#** Geological Survey, Menlo Park, Calif.
**DERIVATION OF FORMULAS AND FORTRAN PROGRAMS TO COMPUTE MAGNETIC ANOMALIES OF PRISMS Final Report, 1973-1974**
Donald Plouff Jul. 1975 117 p refs
(Contract USGS/GD-75/014)
(PB-243525/3) Avail: NTIS HC $5.50 CSCL 08G

Complex geologic bodies can be modeled to meet any standard of esthetics or of accuracy in representation by using an assembiage of polygonal prisms. The basic prisms are easily displayed if the prisms have vertical sides and are bounded at the top and bottom by horizontal planes. The exact formula for the magnetic effect measured at all locations inside, on, or outside polygonal prisms previously has not been reported. The accompanying computer program permits the calculation of the magnetic anomaly for any combination of observation points located as random points, profiles, or two-dimensional grids. GRA

**N76-14680#** National Oceanic and Atmospheric Administration, Boulder, Colo.
**AURORAL ELECTROJET MAGNETIC ACTIVITY INDICES**
Carl C. Abston and Leslie D. Morris Jun. 1975 149 p refs Prepared in cooperation with Natl. Geophys. and Solar-Terrest. Data Center, Boulder, Colo.
(Contract NOAA-75070104)
(COM-75-50279/47; UAG-47) MF $2.25; HC also available from National Climatic Center, Federal Bldg. Atten: Publications, Asheville, N. C. 28801. $25.20/year, $2.10/copy this issue CSCL 04A

The Auroral Electrojet index (AE) is discussed and a brief description is given of the derivation of 11-station 2.5-minute AE indexes for 1973. Tables are given of hourly average indexes for each day of the year, the stations making the main contribution to the hourly indices, and of the average monthly quiet-time level of horizontal fields (H) at each magnetic observatory. Graphs of the index variations are included for each day of 1973. GRA

**N76-14681#** White Sands Missile Range, N.Mex. Atmospheric Sciences Lab.
**ATMOSPHERIC STRUCTURE, WHITE SANDS MISSILE RANGE, NEW MEXICO. PART 3: UPPER AIR AND SURFACE DATA: JALLEN SITE**
Majorie M. Hoidale, Michael P. Dayton, and Lamar Newman Feb. 1975 234 p refs Supersedes DR-776
(DA Proj. 1T6-65702-D-127)
(AD-A013020; DR-879; DR-776) Avail: NTIS CSCL 04/2

A statistical analysis of surface and upper air rawinsonde data is presented for Jallen Site, White Sands Missile Range, New Mexico. Atmospheric parameters covered for the layer from the surface to 100,000 feet above mean sea level are: wind, temperature, pressure, density, moisture, index of refraction and freezing level. Upper air climatological information is based on the period of observation from 1962-1973; while the surface temperature data spans 1963-1973, wind records 1966-1973, and precipitation data 1967-1973. GRA

**N76-14682#** Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
**COMPUTER SIMULATION OF IRRADIANCE MEASUREMENTS FROM AIRCRAFT M.S. Thesis**
Michael R. Poellot and Stephen K. Cox Jan. 1975 59 p refs
(Grant NSF DES-72-01681)
(PB-243422/3; AS-Paper-233) Avail: NTIS HC $4.50 CSCL 04A

A computer simulation developed to optimize the use of the aircraft platform for the measurement of short wave irradiances is described. This model simulates the measurement of radiative fluxes in order to determine the approximate sample sizes required under various conditions of cloudiness. The simulated required sampling length or averaging distance is found to be inversely proportional to the height of the sensor above or below the cloud field. The magnitude of the averaging distance and the

rate of its decrease with height are the result of signal variations on two scales. Near the cloud surface, the data has a high variance due to small scale, large amplitude variations in the irradiance. GRA

**N76-14683#** Stanford Univ., Calif. Stanford Electronics Labs.
**A THEORETICAL STUDY OF ELECTRICAL COUPLING BETWEEN THE TROPOSPHERE, IONOSPHERE, AND MAGNETOSPHERE**
Mongkol Dejnakarintra Dec. 1974 214 p refs
(Grant NSF GA-28042)
(PB-243445/4; SU-SEL-74-051; TR-3454-3) Avail: NTIS HC $7.75 CSCL 04A

Electrical coupling between the earth's lower atmosphere and the ionosphere is investigated theoretically as a three-dimensional boundary value problem. Theories are developed for mapping dc and ultralow frequency (ULF) electric fields in model atmospheres with conductivities generally increasing with altitude. The effects of the geomagnetic field are taken into account above about 70 km altitude. As boundary conditions, a perfectly conducting earth and perfectly conducting geomagnetic field lines above 150 km altitude are assumed. These theories are then applied to two coupling problems: (1) upward mapping of thundercloud electric fields to the ionosphere and magnetosphere, and (2) downward mapping of ionospheric electric fields to the lower atmosphere. GRA

**N76-14684#** Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
**DETECTION OF LONG PERIOD S FROM EARTHQUAKES AND EXPLOSIONS AT LASA AND LRSM STATIONS WITH APPLICATION TO POSITIVE AND NEGATIVE DISCRIMINATION OF EARTHQUAKES AND UNDERGROUND EXPLOSIONS**
R. Blandford and D. Clark 12 Dec. 1974 125 p refs
(Contract F08606-74-C-0006; ARPA Order 1620)
(AD-A013672; SDAC-TR-74-15) Avail: NTIS CSCL 08/11

An improved distance-amplitude relation for long-period S waves was developed and applied to long-period S waves measured from megaton-range explosions. The difference between magnitude determined from the maximum amplitude long-period S waves and magnitude determined from Rayleigh waves is found to be a good discriminant between worldwide earthquakes and explosions at NTS and Amchitka. The long-period SH/Sv ratio is not a discriminant. For possible seismic network, the use of negative discriminants (no detection of S waves) with .01 probability of a false alarm for explosions is shown to result in M sub s Threshold equal to the threshold of 90% probability of detection of S waves from earthquakes by two or more stations. A significant lowering of the negative threshold is possible if one station of the network has an especially low detection threshold. Author (GRA)

**N76-14685#** Naval Surface Weapons Center, Dahlgren, Va.
**ERROR MODEL FOR GEODETIC POSITIONS DERIVED FROM DOPPLER SATELLITE OBSERVATIONS**
R. J. Anderle Aug. 1975 85 p refs
(AD-A013992; NSWC/DL-TR-3368) Avail: NTIS CSCL 08/5

Doppler observations of Navy Navigation satellites have been used to strengthen and extend many terrestrial geodetic networks. The main sources of errors in positions determined from these observations are random error of observations, random and systematic errors in satellite positions due to undercertainties in the gravity field, and biases in the coordinate system in which the satellite ephemeris is given. Effects of uncertainties in the gravity field on station coordinates computed with respect to a precise satellite ephemeris are reduced to about 70 cm after 20 satellite passes are observed, but systematic effects prevent assurance that additional observations will improve the accuracy further. A one part per million reduction in scale must be applied to positions computed with the ephemeris to obtain agreement with terrestrial and other precise determinations of scale. The origin of the system is coincident with the center of mass of the earth to 1 m accuracy but the polar axis may be tilted three to five meters at the earth's surface with respect to coordinate systems upon which star catalogues are based. GRA

**N76-14686#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**TECHNIQUES FOR DEPOSITING VISIBLE SMOKE TRAILS IN THE STRATOSPHERE FOR MEASUREMENT OF WINDS AND TURBULENCE Instrumentation Papers**
William K. Vickery 21 Apr. 1975 19 p refs
(AF Proj. 6687)
(AD-A013792; AFCRL-TR-75-0221) Avail: NTIS CSCL 04/1

Air Force Cambridge Research Laboratories conducted two field programs at the White Sands Missile Range to obtain experimental data for the Climatic Impact Assessment Program of the Department of Transportation. These data provide a prediction of the residence time and behavior of exhaust products deposited by supersonic aircraft in the stratosphere. The data were obtained by photographing smoke trails from rockets and aircraft dispensing systems. This report describes the development and flight results of (1) the rocket dispensing system, designed to produce vertical smoke trails over the 12- to 25-km region, and (2) the aircraft dispensing system, designed to produce horizontal trails at 16- and 20-km altitudes. GRA

**N76-14687#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**AURORAL-IONOSPHERIC VARIABILITY**
C. P. Pike 24 Jul. 1975 30 p
(AF Proj. 7663)
(AD-A013965; AFCRL-TR-75-0391) Avail: NTIS CSCL 04/1

The report discusses various types of auroral conditions which occur frequently and are not necessarily associated with substorms. Specifically, a description of good quality photos is presented for the purpose of illustrating specific points considered significant for interpretation of the photos in terms of ionospheric structure. These photos include extremely quiet conditions as well as extremely disturbed conditions; also included are observations of midday auroras and of auroras in the presence of moonlight. Emphasis is placed on relating auroral patterns to ionospheric structure. GRA

**N76-14688#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**ATLAS OF CLOUD-FREE LINE-OF-SIGHT PROBABILITIES. PART 1: GERMANY Air Force Surveys in Geophysics**
Iver A. Lund, Donald D. Grantham, and Clarence B. Elam, Jr. 8 May 1975 77 p ref
(AF Proj. 8624)
(AD-A013784; AFCRL-AFSIG-309; AFCRL-TR-75-0261) Avail: NTIS CSCL 04/1

This is the first part of a planned Northern Hemisphere atlas of probabilities of cloud-free lines-of-sight between the earth and space, and the earth and an altitude of 2500 m (8200 ft). The probabilities are for the mid-season months-January, April, July, and October; four times of the day-0000-0200 LST, 0600-0800 LST, 1200-1400 LST, and 1800-2000 LST; and four elevation angles- 10, 30, 50, and 90 degrees. GRA

**N76-14689#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**GLOBAL MORPHOLOGY OF IONOSPHERIC SCINTILLATIONS, 2 Air Force Surveys in Geophysics.**
Jules Aarons 11 Mar. 1975 28 p refs
(AF Proj. 4643)
(AD-A013785; AFCRL-AFSIG-304; AFCRL-TR-75-0135) Avail: NTIS CSCL 04/1

Updating a review of the global morphology of ionospheric scintillations published in 1971, this study adds additional experimental studies on familiar topics to newer types of measurements of ionospheric irregularities, including in situ experiments and artificial heating of the F-layer. GRA

**N76-14690#** Aerospace Corp., El Segundo, Calif. Space Physics Lab.
**THE ENERGETIC ELECTRON ENVIRONMENT IN CIRCULAR POLAR ORBITS Interim Report**
Alfred L. Vampola 15 Jul. 1975 60 p refs
(Contract F04701-75-C-0076)
(AD-A013689; TR-0076(6260-20)-2) Avail: NTIS CSCL 04/1

Energetic electron measurements made during the latter half of 1966 by a magnetic spectrometer on spacecraft 1966-70A

(OV3-3) are used to provide plots of the probability function P(f=f sub 0) for circular polar orbits at various altitudes under varying magnetospheric conditions. The plots are intended for use in determining the total fluence to which low-altitude polar-orbiting satellites will be exposed and also the probability that a critical threshold flux at a given energy will be exceeded. GRA

**N76-14691#** Aerospace Corp., El Segundo, Calif.
**ELECTRON FLUXES AND CORRELATION WITH QUIET-TIME AURORAL ARCS Interim Report**
P. F. Mizera, D. R. Croley, Jr., F. A. Morse, and A. L. Vampola 30 Jul. 1975 40 p refs
(Contract F04701-75-C-0076)
(AD-A013690; TR-0076(6260-20)-4; SAMSO-TR-75-202) Avail: NTIS CSCL 04/1

Primary electron fluxes, measured by two satellites as they crossed quiet-time auroral arcs, are presented for times near 14:20 UT on Nov 12, 1972. The DMSP-30 satellite measured the optical intensity at 0.6 to 1.0 microns (FWHM) and precipitated electrons with 0.22< or equal to E< or equal to 19.7 keV near 2100 MLT. The 72-1 satellite crossed the auroral arc system near 2200 MLT and measured 0.36 to 16.5 keV electrons, at all pitch angles. A detailed description of the electron morphology that includes comparisons of electron fluxes with optical intensities is presented. Optical intensities extending from 2100 - 2200 MLT correlate best with electrons with E > 1 keV. The strongest emission bands at these near infrared wavelengths are N2(1P) and N2(+)(M). Between 4 - 10% of the primary electron energy input is converted to an optical intensity of 140 kR between 0.6 - 1.- microns (FWHM) and is equivalent to a weak IBC2 in the 5577 A green line of atomic oxygen. GRA

**N76-14692#** Texas Instruments, Inc., Dallas. Equipment Group.
**VELA NETWORK EVALUATION AND AUTOMATIC PROCESSING RESEARCH Final Report**
David G. Lambert, Alexandra I. Tolstoy, and Ervin S. Becker 9 Dec. 1974 359 p refs
(Contract F08606-74-C-0033; ARPA Order 2551)
(AD-A013966; TI-ALEX(01)-TR-74-07; TR-7) Avail: NTIS CSCL 17/10

The report presents the final results of the continued evaluation of the capability of the single Very Long Period Experimental (VLPE) station, the VLPE network, and the VLPE-ALPA NORSAR combined network to detect and discriminate between presumed underground explosions and shallow earthquakes located in Eurasia. Presented is a summary of the important results pertaining to the studies of long-period earth noise, and the application of matched filters and the Three-Component Adaptive processor to VLPE data. The evaluation was conducted by Texas Instruments Incorporated at the Seismic Data Analysis Center over the period 1 November 1973 to 30 November 1974. GRA

**N76-14693#** Woods Hole Oceanographic Institution, Mass.
**COLLECTION AND ANALYSIS OF SEISMIC WIDE ANGLE REFLECTION AND REFRACTION DATA USING RADIO SONOBUOYS**
S. T. Knott and Hartley Hoskins Jul. 1975 99 p refs
(Contract N00014-74-C-0262; NSF GA-27516; NR Proj. 083-004)
(AD-A013605; WHOI-75-33) Avail: NTIS CSCL 17/10

Information and velocities of compressional waves and thicknesses of layers in the oceanic sediments and basement can be gathered by use of sonobuoys to receive repetitive sound sources (sparkers and airguns) over wide-angle or oblique sound paths. In order to obtain data of sufficient quality to ensure accurate and reproducible results by this method, it is essential that proper techniques be used in the original data acquisition, recording of ancillary data, and playback and analysis of the records. Detailed instructions are provided for field data collection, and for subsequent data playback and analysis, including suggestions for recording formats and scales. Author (GRA)

**N76-14694#** RAND Corp., Santa Monica, Calif.
**SOVIET STRONG-MOTION AND VIBRATION-AND-BLAST SEISMOGRAPHS Interim Report**
Charles Shishkevish Jul. 1975 98 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-A013668; R-1652-ARPA) Avail: NTIS CSCL 17/10

This report contains a description of the current state of the art of Soviet strong-motion and vibration-and-blast seismographs, taken from Soviet publications available in the United States through early 1975. It is intended primarily for U.S. seismologists working with strong-motion data, and persons interested in Soviet advances in seismic instruments. The report contains: (1) four tables listing the technical specifications of Soviet seismometers and accelerometers used most widely in galvanometrically recording strong-motion seismographs: (2) a description of recorders; characteristics of four of the most widely used strong-motion instruments; and specifications of direct-recording, three-component seismograph systems. Also treated are auxiliary equipment, including seismic triggers, and seismic engineering networks. An extensive bibliography is included. GRA

**N76-14695#** Photometrics, Inc., Lexington, Mass.
**DENSITOMETRIC ANALYSIS TO DETERMINE ARTIFICIAL CLOUD EXPANSION CHARACTERISTICS**
Christian A. Trowbridge and Irving L. Kofsky 14 Mar. 1975 51 p refs
(Contract F19628-72-C-0259; AF Proj. 8605)
(AD-A013777; PhM-102-75; AFCRL-TR-75-0147) Avail: NTIS CSCL 04/1

Microdensitometric film reduction and computer analysis and display techniques were applied to optical data on smoke and chemical tracers in the stratosphere and upper atmosphere. Photographic brightness distributions were converted to digital optical density arrays recorded on magnetic tape and subsequently reduced by statistical and Fourier methods to determine turbulence parameters and diffusion coefficients. Stratospheric wind data derived by the smoke trail method were spectrum analysed and Richardson numbers determined. A new approach to separation of turbulence data from the mean wind was used and an alternative to Fourier methods implemented for spectrum analysis. GRA

**N76-14696#** Illinois Univ., Urbana. Dept. of Electrical Engineering.
**MOTIONS IN THE IONOSPHERE**
Kung C. Yeh and Chao H. Liu May 1975 68 p refs
(Contract F19628-74-C-0044; Grant NSF GA-42857; AF Proj. 4643)
(AD-A013780; UILU-ENG-75-2546; AFCRL-TR-75-0334; TR-55; SR-2) Avail: NTIS CSCL 04/1

Atmospheric motions at ionospheric heights are discussed. Various ionospheric processes and the time constants with which these different processes may take place are covered. GRA

**N76-14697#** IIT Research Inst., Chicago, Ill.
**COMPOSITION OF THE ATMOSPHERE AT 10,000-40,000 FEET USING A MODIFIED MATRIX ISOLATION TECHNIQUE Final Report, 1 Dec. 1973 - 30 Jun. 1975**
Alan Snelson 1975 30 p refs
(Contract F44620-74-C-0033; AF Proj. 6813; AF Proj. 9750)
(AD-A013913; IITRI-C6303-9; AFOSR-75-1171TR) Avail: NTIS CSCL 04/1

A mechanical cryogenic air sampler was adapted so that optical measurements could be made on a frozen air sample. Air samples were to be collected in the 10,000 to 40,000 ft range, but due to aircraft availability difficulties, no air samples were obtained; laboratory studies showed that IR optical spectroscopy was suitable for measuring water vapor and CO2 concentrations at less than 1ppm. Calibration curves for CH4, CO, CO2, N2O and H2O were obtained in the ranges that these gases are found in the atmosphere. GRA

**N76-14698#** Air Force Weapons Lab., Kirtland AFB, N.Mex.
**ELECTROMAGNETIC ATTENUATION PROPERTIES OF CLAY AND GRAVEL SOILS Final Report, Feb. - Jun. 1974**
Dennis L. Brown Jul. 1975 27 p refs
(AD-A013771; AFWL-TR-74-166) Avail: NTIS CSCL 13/2

The electromagnetic attenuation properties of clay and gravel soils were measured as a function of moisture content and frequency. Measurements were done at frequencies in the 0.5 to 4.5 GHz range. Soil samples were compounded in the

laboratory at approximately 10, 50, and 90 percent saturation. Sample thickness was in the range of 2.5 to 20.3 cm. Each homogeneous sample was sealed in a polyethylene container to retain the total moisture and maintain a constant moisture profile with depth. The results indicate that this method cannot satisfactorily determine the thickness of gravel or clay soil layers over a range of moisture contents which would be experienced in field conditions. GRA

**N76-14699#** Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
**PHYSICS AND CHEMISTRY OF ATMOSPHERES Final Report, May - Dec. 1974**
Billy M. McCormac 9 Apr. 1975 50 p refs Presented at the Summer Advanced Study Inst. Phys. and Chem. of Atmospheres, Liege, Belgium, 29 Jul. - 9 Aug. 1974
(Contract DNA001-74-C-0141; DNA Proj. NWED-QAXH-D028) (AD-A013937; LMSC-D407479; DNA-3573F) Avail: NTIS CSCL 04/1

The Advanced Study Institute, 'Physics and Chemistry of Atmospheres', held at the University of Liege, Liege, Belgium, July 29 - August 9, 1974, was attended by 119 persons from 10 different countries. The objective of the Institute was to correlate the diverse aspects of atmospheric research to achieve a better understanding of the atmospheres of the earth as well as the nearer planets. Not only aerodynamics, astronomy, chemistry, and physics are involved, but each of these, particularly physics, is highly subdivided. This paper is a summary of some of the significant findings reported at the Institute. GRA

**N76-14700#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**AN IONOSPHERIC SUBSTORM MODEL Interim Report**
C. P. Pike, S.-I. Akasofu, and R. A. Wagner 24 Jul. 1975 35 p refs Repr. from Def. Meteorol. Satellite program Auroral-Ionospheric Interpretation Guide, Apr. 1975 p 17-49 (AF Proj. 7663)
(AD-A013964; AFCRL-TR-75-0390; AFCRL-TR-75-0191) Avail: NTIS CSCL 04/1

An ionospheric substorm model is presented in schematic form for the nightside. The purpose of the model is to provide a basis for identifying in DMSP photos the different phases of an ionospheric substorm and to estimate how some associated ionospheric parameters would vary during the substorm. GRA

**N76-14701#** Aerospace Corp., El Segundo, Calif. Space Physics Lab.
**ATMOSPHERIC DENSITY AT 169 km FROM ACCELEROMETER MEASUREMENTS AND ORBITAL DECAY OF A LOW-ALTITUDE SATELLITE Interim Report**
B. K. Ching and H. R. Rugge 30 Jul. 1975 29 p refs
(Contract F04701-75-C-0076)
(AD-A013692; TR-0076(6960)-4; SAMSO-TR-75-200) Avail: NTIS CSCL 04/1

Atmospheric densities at 169 km were obtained for the period 19 August - 3 September 1970 from the measurements of an accelerometer on a low-altitude satellite and from the orbital decay of the same satellite. Three different sets of local-time and latitude conditions were provided by the data; two from the accelerometer measurements, before and after perigee, and one at perigee, from the oribital decay data. GRA

**N76-14702#** Aerospace Corp., El Segundo, Calif. Space Physics Lab.
**PROTON PRECIPITATION BY A WHISTLER-MODE WAVE FROM A VLF TRANSMITTER Interim Report**
Harry C. Koons 14 Jul. 1975 19 p refs
(Contract F04701-75-C-0076)
(AD-A013691; TR-0076(6960-02)-1; SAMSO-TR-75-187) Avail: NTIS CSCL 04/1

Protons with 50 KeV E < 530 KeV were detected by sensors aboard satellite 1972-76B at an altitude of 700 km in the region conjugate to the transportable very-low-frequency (TVLF) transmitter which was being operated near Anchorage, Alaska (L approximately 4). Temporal maxima in the proton count rates can be identified on a one-to-one basis with short pulsed transmissions by the VLF transmitter. The observed time delay between the center of a transmitted pulse and the detection of the next maximum in the proton count rate at the sensor agrees well with the delay predicted from a simple plasmaspheric model. Author

**N76-14703#** Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.
**BAND MODEL CALCULATION OF ATMOSPHERIC TRANSMITTANCE FOR HOT GAS LINE EMISSION SOURCES. ACCOUNT OF DOPPLER BROADENING Interim Report**
Stephen J. Young 30 Jul. 1975 63 p refs
(Contract F04701-75-C-0076; DARPA Order 2843)
(AD-A013719; TR-0076(6970)-5; SAMSO-TR-75-212) Avail: NTIS CSCL 04/1

The effective transmittances along a slant path from the source altitude to space at a zenith angle of 75 deg are computed and averaged over three wide bandpasses in the 2.7 micrometer spectral region. Statistical band model calculations are performed for the assumption that the emission-absorption lines have a Lorentz, Doppler, or Voigt profile. Inhomogeneities inherent in treating the line of sight through the atmosphere and the hot gas source as a single, highly inhomogeneous optical path are accounted for by using either the Curtis-Godson, the Lindquist-Simmons, or the two-path derivative approximation. The latter is derived herein and is shown to be superior to the Lindquist-Simmons approximation in treating radiative transfer calculations for the Doppler or Voigt line shape. With line shape properly accounted for, the results still indicate a large difference between the effective atmospheric transmittance and the atmospheric transmittance appropriate for continuum emission. This large difference can result only from the high degree of line correlation that exists between the hot H2O/CO2 emission spectrum and the cool H2O/CO2 atmospheric absorption spectrum. GRA

**N76-14531*** Appleton Lab., Slough (England).
**MAGNETOMETEOROLOGY: RELATIONSHIPS BETWEEN THE WEATHER AND EARTH'S MAGNETIC FIELD**
J. W. King and D. M. Willis *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 39-41 refs (For availability see N76-14528 05-42)
CSCL 08N

**N76-14533*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**PROPOSED GEOMAGNETIC CONTROL OF SEMIANNUAL WAVES IN THE MESOSPHERIC ZONAL WIND**
A. D. Belmont (Control Data Corp.), G. D. Nastrom (Control Data Corp.), and Hans G. Mayr *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 47-52 refs Sponsored in part by DOT (For availability see N76-14528 05-42)
(Contract N00014-72-C-0308)
CSCL 04A

**N76-14534*** Academy of Sciences (USSR), Moscow.
**CERTAIN REGULARITIES OF GEOMAGNETIC AND BARIC FIELDS AT HIGH LATITUDES**
S. M. Mansurov, G. S. Mansurov, and L. G. Mansurova *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 53-58 refs (For availability see N76-14528 05-42)
CSCL 04A

**N76-14535*** Colorado State Univ., Fort Collins.
**ON POSSIBLE INTERACTIONS BETWEEN UPPER AND LOWER ATMOSPHERE**
Bruce C. MacDonald and Elmar R. Reiter *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 59-69 refs Sponsored by ERDA (For availability see N76-14528 05-42)
CSCL 04A

**N76-14538*** Aerospace Corp., El Segundo, Calif.
**THE AURORA AS A SOURCE OF PLANETARY-SCALE WAVES IN THE MIDDLE ATMOSPHERE**
Y. T. Chiu and J. M. Straus *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 83-87 refs (For availability

see N76-14528 05-42)
(Contract F04701-73-C-0074)
CSCL 04A

**N76-14541*** Stanford Univ., Calif.
**GEOMAGNETIC RESPONSES TO THE SOLAR WIND AND THE SOLAR ACTIVITY**
Leif Svalgaard *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 119-142 refs (For availability see N76-14528 05-42)
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF GA-31138)
CSCL 08N

**N76-14543*** National Aeronautics and Space Administration. Goddard Space Flight Center, Albuquerque, N. Mex.
**POSSIBLE RELATIONSHIPS BETWEEN SOLAR ACTIVITY AND ATMOSPHERIC CONSTITUENTS**
Robert G. Roosen and Ronald J. Angione (San Diego State Univ.) *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 149-154 refs (For availability see N76-14528 05-42)
CSCL 04A

**N76-14544*** National Oceanic and Atmospheric Administration, Washington, D.C.
**FUTURE MONITORING OF CHARGED PARTICLE ENERGY DEPOSITION INTO THE UPPER ATMOSPHERE AND COMMENTS ON POSSIBLE RELATIONSHIPS BETWEEN ATMOSPHERIC PHENOMENA AND SOLAR AND/OR GEOMAGNETIC ACTIVITY**
D. J. Williams, R. N. Grubb, D. S. Evans, and H. H. Sauer *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 155-159 refs (For availability see N76-14528 05-42)
CSCL 08N

**N76-14546*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**HIGH-LATITUDE IONOSPHERIC WINDS RELATED TO SOLAR-INTERPLANETARY CONDITIONS**
J. P. Heppner *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 167-170 refs (For availability see N76-14528 05-42)
CSCL 04A

**N76-14551*** Alaska Univ., Fairbanks. Geophysical Inst.
**AURORAL EFFECTS IN THE D REGION OF THE IONOSPHERE**
Syun-Ichi Akasofu *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 213-223 refs (For availability see N76-14528 05-42)
CSCL 03A

**N76-14552*** Toronto Univ. (Ontario).
**TWO POSSIBLE MECHANISMS FOR RELATING TERRESTRIAL ATMOSPHERIC CIRCULATION TO SOLAR DISTURBANCES**
C. O. Hines *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 225-226 refs (For availability see N76-14528 05-42)
CSCL 03A

**N76-14553*** National Center for Atmospheric Research, Boulder, Colo.
**CORRELATIONS AND LINKAGES BETWEEN THE SUN AND THE EARTH'S ATMOSPHERE: NEEDED MEASUREMENTS AND OBSERVATIONS**
William W. Kellogg *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 227-237 refs (For availability see N76-14528 05-42)
CSCL 04A

# 47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

**N76-14704** New York Univ., N.Y.
**A NONLINEAR PARABOLIC EQUATION WITH APPLICATIONS TO CLIMATE THEORY Ph.D. Thesis**
Michael Ghil 1975 75 p
Avail: Univ. Microfilms Order No. 75-28532

A nonlinear parabolic partial differential equation arising in climate theory is studied. The equation is singular at one boundary point and has time-independent coefficients; it admits steady-state solutions. The nonlinearity leads to the existence of more than one such steady state. Three of the steady states found are positive-valued, and hence have physical significance as possible climates of the earth; they correspond to the present climate, to an ice age and to an entirely ice-covered planet, respectively. A stability criterion is derived for the linear stability of these steady states. A variational principle is introduced in order to also study nonlinear stability. Two of the steady states appear by spontaneous bifurcation when varying a physically important parameter. Dissert. Abstr.

**N76-14705** British Library Lending Div., Boston Spa (England).
**THE FORMATION AND FORECASTING OF LOW CLOUD**
K. G. Abramovic [1975] 112 p refs Transl. into ENGLISH from T. Gidrometcentr (Leningrad), v. 78, 1973 p 2-123
(BLL-M-23588-(5828.4F)) Avail: Bristish Library Lending Div., Boston Spa, Engl.: 11 BLL photocopy coupons

The structure of the lower cloud boundary is examined along with the conditions favorable for the occurrence and evolution of low cloud. Forecasting principles and methods for compiling forecasts of the height of the lower cloud boundary are included. Author

**N76-14706** British Library Lending Div., Boston Spa (England).
**GENERAL ATMOSPHERIC CIRCULATION**
H. P. Pogosjan, A. A. Pavlovskaja, and M. V. Sabelnikova [1975] 67 p refs Transl. into ENGLISH from Gidromet. Nauc.-Issled. Cent. SSSR (USSR), v. 126, 1974
(BLL-M-23778-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 7 BLL photocopy coupons

The results are presented of research into quasi-biennial and 6-month cycles in the winds of the equatorial stratosphere and an explanation is provided of the nature of the semi-annual cyclicity. Features of the quasi-biennial cycles and the modelling of the global geopotential field for the westerly and easterly phases of circulation are studied to determine the differences between the fields of temperature and geopotential during these two phases. It is established that no link exists between the 6-month and quasi-biennial cycles, and a hypothesis is proposed to account for the origin of westerly winds in the equatorial stratosphere. Author

**N76-14707#** Committee on Interstate and Foreign Commerce (U. S. House).
**WEATHER MODIFICATION AND EARLY-WARNING SYSTEMS**
Washington GPO 1974 80 p Hearing on H.R. 14485, H.R. 15008, and S. 3320 before Subcomm. on Commun. and Power of Comm. on Interstate and Foreign Commerce, 93d Congr., 2d Sess., 2 Jul. 1974
(GPO-38-361) Avail: Subcomm. on Commun. and Power

Congressional testimony regarding existing and potential developments in weather early warning systems is reported. Legislation requiring the reporting of weather modification activities to the Federal Government was also considered.D.M.L.

**N76-14708*#** Techno-Sciences, Inc., Costa Mesa, Calif.
**REDUCTION AND ANALYSIS OF DATA COLLECTED DURING THE ELECTROMAGNETIC TORNADO EXPERIMENT Interim Report, Jul. - Sep. 1975**
L. D. Davisson and J. Bradbury Oct. 1975 19 p
(Contract NAS5-22489)
(NASA-CR-144699; TSI-75110) Avail: NTIS HC $3.50 CSCL 04B

Progress is reviewed on the reduction and analysis of tornado data collected on analog tape. The strip chart recording of 7 tracks from all available analog data for quick look analysis is emphasized. Author

**N76-14709*#** Scientific Translation Service, Santa Barbara, Calif.
**REPORT ON SCIENTIFIC ACTIVITY IN METEOROLOGY AND ATMOSPHERIC PHYSICS, 1971 - 1974**
M. I. Yudin Washington NASA Dec. 1975 208 p refs Transl. into ENGLISH from Soobshch. o Nauchn. Rabotakh po Meteorol. i Fiz. Atmosfery, 1971 - 1974 Moscow, Acad. of Sci. USSR, 1975 p 7-207 Presented at the Intern. Assoc. of Meteorl. and Atm. Phys. for 16th Gen. Assembly of the IUGG (Contract NASw-2791)
(NASA-TT-F-16663) Avail: NTIS HC $7.75 CSCL 04B

Dynamic meteorology and numerical weather forecasting are discussed. Polar meteorology, actinometry, atmospheric optics, and cloud physics are studied. An investigation is also made of radio meteorology, chemistry and air pollution, and atmospheric electricity. Author

**N76-14710*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**STUDY OF THE LOWER STRATOSPHERIC THERMAL STRUCTURE AND TOTAL OZONE FROM NIMBUS-4 IRIS**
C. Prabhakara Washington Jan. 1976 35 p refs
(NASA-TN-D-8134; G-7620) Avail: NTIS HC $4.00 CSCL 04B

The global distribution of temperature in the stratosphere from 100 to 10 mbar and the total ozone in the atmosphere are remotely sensed from the Nimbus-4 IRIS measurements for a period of about one year. The temperature and ozone data are presented in the form of monthly mean global maps. The standard deviations of temperature and ozone with respect to zonal averages are calculated. The mean and the variable state of the stratosphere are discussed with the help of these observations. The lower stratosphere in the tropical regions reveals a significant wave number one pattern in the circulation. The Arctic and Antarctic stratospheric winter circulation regimes display a different behavior apparently due to the ocean and orographic differences. Author

**N76-14711*#** Texas A&M Univ., College Station.
**RELATIONSHIPS BETWEEN STRATOSPHERIC CLEAR AIR TURBULENCE AND SYNOPTIC METEOROLOGICAL PARAMETERS OVER THE WESTERN UNITED STATES BETWEEN 12-20 km ALTITUDE Final Report**
James R. Scoggins, Terry L. Clark, and Norman C. Possiel Dec. 1975 162 p refs
(Grant NGR-44-001-081)
(NASA-CR-143837; H-919) Avail: NTIS HC $6.75 CSCL 04B

Procedures for forecasting clear air turbulence in the stratosphere over the western United States from rawinsonde data are described and results presented. Approaches taken to relate meteorological parameters to regions of turbulence and nonturbulence encountered by the XB-70 during 46 flights at altitudes between 12-20 km include: empirical probabilities, discriminant function analysis, and mountainwave theory. Results from these techniques were combined into a procedure to forecast regions of clear air turbulence with an accuracy of 70-80 percent. A computer program was developed to provide an objective forecast directly from the rawinsonde sounding data. Author

**N76-14712#** National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
**A PRELIMINARY STUDY OF REMOTE SENSOR APPLICATIONS TO LOCAL WEATHER SERVICES**
Roger S. Rhodes Apr. 1975 39 p refs
(COM-75-11046/0; NOAA-TR-ERL-330; WPL-40; NOAA-7571102) Avail: NTIS HC $4.00; HC also available from SOD as C55.13:ERL-330-WPL-40 CSCL 04B

A study was initiated by NOAA's Wave Propagation Laboratory to gain greater insight into the most effective ways for new sensor technology programs to benefit the local weather services. The objectives were to clarify the general nature of local weather services, to establish the relative importance and utility of each service output, and to develop a frame of reference for planning future sensor research activity. While it does not provide the final answer to these objectives, this report presents a preliminary analysis of these important areas. The conclusion is reached that the first productive user of new sensor technology is most likely to be atmospheric research programs, with operational use evolving later. Improved communications between the sensor development agencies and the various user groups is recommended. GRA

**N76-14713#** RAND Corp., Santa Monica, Calif.
**AN INITIAL VALUE METHOD FOR DUAL INTEGRAL EQUATIONS WITH BESSEL FUNCTION KERNELS**
H. H. Kagiwada and R. E. Kalaba Apr. 1975 21 p refs
(Contract C-5-35179)
(COM-75-11027/0; R-1745-DOC; NOAA-75070802) Avail: NTIS HC $3.25 CSCL 04B

The purpose of this report was to develop a practical method for solving the temperature sounding problem for a cloud-free atmosphere by an initial value approach based on previous imbedding studies. Traditional methods for solving temperature inversion problems lead to integral equations of the first kind, which are extremely difficult to solve numerically. On the other hand, digital computers are well suited to the numerical integration of large systems of ordinary differential equations with initial conditions. The transformation of a certain class of such integral equations into Fredholm integral equations of the second kind are considered. These are further reduced to Cauchy systems, i.e., initial value problems. Such Cauchy systems offer the hope of computational advantages. To apply this result to the atmospheric temperature problem would involve finding an appropriate representation for the actual kernel in terms of an expansion of Bessel functions. GRA

**N76-14714#** Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
**STATISTICAL METHOD OF THE SHORT-RANGE FORECAST OF WEATHER WITH THE AID OF THE INTERPRETATION OF PROGNOSTIC CHARTS ACCORDING TO ANALOG METHOD**
Butenberg 26 Nov. 1974 22 p Transl. into ENGLISH from the mono. "Primenenie Statisticheskikh Metodov v Meteorologii" Leningrad, 1971 p 31-35
(AD-A004683; FTD-MT-24-2282-74) Avail: NTIS CSCL 04/2

The short-range forecast of weather using the method worked out in the central weather bureau of the weather service of the German Democratic Republic in Potsdam is described. GRA

**N76-14715#** New York Univ., N.Y. Inst. of Mathematical Sciences.
**STABILITY OF RECTILINEAR GEOSTROPHIC VORTICES IN STATIONARY EQUILIBRIUM**
Louis Bauer and George K. Morikawa Apr. 1975 76 p refs
(Grant AF-AFOSR-2728-74; ARPA Order 2274)
(AD-A013839; IMM-406; AFOSR-75-1154TR) Avail: NTIS CSCL 04/2

A hemispherical barotropic model of global-scale atmospheric motions is studied in a planar approximation using three (K sup 0) (Bessel)-vortices of equal strength gamma and length scale 1/Kappa to represent the sub-tropical semi-permanent high pressure systems. In equilibrium these anticyclonic vortices are equally spaced on a latitude circle of radius a. GRA

**N76-14716#** Air Weather Service, Scott AFB, Ill.
**THE AWS HANDBOOK OF GROUND-BASED COLD FOG DISSIPATION USING VENTED LIQUID PROPANE. VOLUME 1: THEORY AND PRACTICE**
Henry A. Chary and Ronald L. Lininger Jul. 1975 63 p refs
(AD-A013797; AWS-TR-75-255-Vol-1) Avail: NTIS CSCL 04/2

The theory and practice of ground-based cold fog dissipation using vented liquid propane are explained. The cumulative AWS expertise in ground-based cold fog dissipation is summarized. Cold fog dissipation is dependent on the phase transition of liquid water to ice. The ice phase is initiated by severe local cooling due to the adiabatic expansion of vented liquid propane. The ice crystals grow at the expense of the supercooled fog droplets and fall out, thus effecting a clearing. Three operational

cold fog dissipation networks are illustrated. Generalized guidance for planning, procuring, installing, and operating a cold fog dissipation system are given. GRA

**N76-14717#** Environmental Prediction Research Facility (Navy), Monterey, Calif.
**INTERRELATIONSHIPS BETWEEN TROPICAL NORTH PACIFIC ATMOSPHERIC CIRCULATION, EXPLOSIVE VOLCANISM, SEA SURFACE TEMPERATURE AND WESTERN NORTH PACIFIC TROPICAL STORMS AND TYPHOONS**
J. F. Harding and S. Larson Aug. 1975 28 p refs
(AD-A014083; ENVPREDRSCHF-Tech-Note-22) Avail: NTIS CSCL 04/2

Time series of surface atmospheric pressure and sea surface temperature are presented for three areas spanning the tropical North Pacific (Equator to 15N) from the Central American coast to the coast of Asia. Surface pressure time series are shown for the period between 1946 and 1974, while sea surface temperature data are presented for the period between 1962 and 1974. The relation between the Northern Hemisphere manifestation of Walker's 'Southern Oscillation' and the occurrence of warm and cold sea surface temperatures in the eastern tropical Pacific is shown to support estimates of transport by the Equatorial Countercurrent. Large stratospheric injections of dust and gas by volcanic eruption are shown to generally preceed marked increases in the estimated transport by the Equatorial Countercurrent. Minima of tropical storm and typhoon frequency in the tropical northwest Pacific (especially since 1957) are shown to be associated with low east-west pressure across the equatorial Pacific while frequency maxima are associated with high east-west pressure differences. GRA

**N76-14718#** Brown Univ., Providence, R.I. Dept. of Geological Sciences.
**THE DYNAMICS OF NATURAL CLIMATIC CHANGE Final Report, 15 Jun. - 15 Dec. 1974**
John Imbrie, R. K. Matthews, and Thompson Webb, III 17 Jul. 1975 83 p refs
(Contract F44620-73-C-0021; ARPA Order 2299)
(AD-A013632; AFOSR-75-1076TR) Avail: NTIS CSCL 04/2

This document summarizes the results of the ARPA Paleoclimate Projects at Brown, with emphasis on work accomplished during the period 15 June 1974 through 15 December 1974. These results include: (1) completion of a numerical experiment on ice-age climate; (2) organization of a data-exchange program with the Soviet Union; (3) formation and analysis of a data bank for pollen data; (4) analysis of the phasing of changes in oceanic circulation and changes in nearby climate and vegetation patterns on land; (5) completion of a review and critique of transfer-function methodology; and (6) documentation of sea-level dynamics during the interval 60,000 - 250,000 YBP. GRA

**N76-14719#** Environmental Technical Applications Center (Air Force), Washington, D.C.
**AUTUMN WEATHER PATTERNS OF THE WESTERN UNITED STATES**
Jul. 1975 68 p refs
(AD-A013801; USAFETAC-TN-75-4) Avail: NTIS MF $2.25 CSCL 04/2

Reprints of Western Region Technical Attachments 73-35 with Supplement 74-27, 73-39 with Supplement 74-32, and 73-41 are compiled to furnish an excellent climatic guide to Autumn weather patterns over the western United States. The data covers the months of September, October, and November and concerns most of the normally-observed weather parameters. GRA

**N76-14720#** Air Weather Service, Scott AFB, Ill.
**AIR WEATHER SERVICE MODIFICATION PROGRAM (8TH) FY 1975**
Ronald L. Lininger Jul. 1975 9 p refs
(AD-A013727; AWS-TR-75-257) Avail: NTIS CSCL 04/2

The Air Weather Service performed cold-fog seeding at three bases again during the winter of FY 1975. Results are presented in terms of assisted landings or takeoffs. Cost/benefit figures are cited, showing a total net benefit of about $98,000 for the three bases and for the season. GRA

**N76-14721#** Naval Postgraduate School, Monterey, Calif.
**A MICROPROCESSOR-BASED COMMUNICATIONS INFORMATION SYSTEM M.S. Thesis**
Robert Harry Ekstrom and William Henry Reinhardt, III Jun. 1975 110 p refs
(AD-A013624) Avail: NTIS CSCL 09/2

A functional design of a microprocessor-based system is proposed as a model for the Naval Enivronmental Display Station for use by the Naval Weather Service Environmental Detachments. The design consists of four modules: control, communications, storage, and display. A software program prototype that simulates many of the proposed functions of the control module is discussed. The processing requirements for the communications module are presented along with a proposed hardware configuration. The storage module, based on a floppy disk system, is explained and its required functions defined. A display module using an intelligent terminal and two CRTs is considered. The microprocessing system was designed to show not only the power and flexibility of this system, but also to demonstrate a potential application of low cost microprocessor technology. GRA

**N76-14722#** North Carolina State Univ., Raleigh. Dept. of Geosciences.
**EFFECTS OF ATMOSPHERIC AEROSOLS ON INFRARED IRRADIANCE AT THE EARTH'S SURFACE IN A NONURBAN ENVIRONMENT Environmental Monitoring Series**
Michael R. Riches, James T. Peterson, and Edwin C. Flowers 17 Dec. 1975 44 p refs
(PB-243635/0; EPA-650/4-75-017) Avail: NTIS HC $4.00 CSCL 04A

A study is described which was designed to measure hemispheric infrared downward-directed irradiance at the earth's surface and ambient aerosol concentrations. A Funk-type net radiometer (with a blackened cavity on the underside) was used to measure the incident all-wave energy. From the value obtained, the observed solar radiation was subtracted to determine the infrared component. The expected incident infrared irradiance was calculated from prevailing atmospheric conditions. Six methods were used for these calculations: four empirical equations based on surface conditions, the Yamamoto chart, and a radiative transfer program using vertical profiles of temperature and moisture. The observed-minus-calculated downwelling irradiances were compared to concurrent measurements of turbidity obtained with a Volz sunphotometer, nephelometer-indicated atmospheric extinction coefficient, and a relative humidity. GRA

**N76-14723#** North Carolina State Univ., Raleigh.
**SOME TOPICS RELATING TO MODELLING OF DISPERSION IN BOUNDARY LAYER**
F. Pasquill Apr. 1975 69 p refs Sponsored by EPA
(PB-243524/6; EPA-650/4-75-015; EPA-R-800662) Avail: NTIS HC $4.50 CSCL 04A

Modeling of dispersion in the atmospheric boundary layer is considered. Topics discussed include: the second-order closure modelling of turbulence; crosswind dispersion and the properties of turbulence; wind direction fluctuation statistics over long sampling times; 'local similarity' treatment of vertical spread from a ground source; representations of dispersion in terms of distance of time; and modelling for elevated sources. GRA

**N76-14724#** National Weather Service, Silver Spring, Md. Office of Hydrology.
**STORM TIDE FREQUENCY ANALYSIS FOR THE COAST OF NORTH CAROLINA, SOUTH OF CAPE LOOKOUT**
Francis P. Ho and Robert J. Tracey 17 Dec. 1975 52 p refs
(COM-75-11000/7; NOAA-TM-NWS-HYDRO-21; NOAA-75061901) Avail: NTIS HC $4.50 CSCL 04B

Storm tide height frequency distributions were developed on the coast of North Carolina, south of Cape Lookout, for the National Flood Insurance Program by computing storm tides from a full set of climatologically representative hurricanes, using the hydrodynamic storm surge model. Tide levels are shown in coastal profile between annual frequencies of 0.10 and .002. The report is intended for use in estimating actuarial risk to buildings from coastal floods and in land use management. GRA

**N76-14725#** National Weather Service, Silver Spring, Md. Office of Hydrology.

**STORM TIDE FREQUENCY ANALYSIS FOR THE COAST OF PUERTO RICO**

Francis P. Ho May 1975 50 p refs
(COM-75-11001/5; NOAA-TM-NWS-HYDRO-23; NOAA-75062503) Avail: NTIS HC $4.00 CSCL 04B

Storm tide height frequency distributions in the coast of Puerto Rico were developed for the National Flood Insurance Program by computing storm tides from a full set of climatologically representative hurricanes, using a hydrodynamic storm surge model adapted to local conditions. Hurricane parameters are analyzed and presented. Tide levels for the southern coast of Puerto Rico are shown in coastal profile between annual frequencies of 0.10 and .002. Similar tide levels for San Juan on the northern coast and Mayaquez on the western coast are also presented, and tentative interpolated tide levels of .01 annual frequency for the remaining coasts. Wave effects on the north coast are discussed. GRA

**N76-14726#** National Weather Service, Silver Spring, Md.

**SOME CLIMATOLOGICAL CHARACTERISTICS OF HURRICANES AND TROPICAL STORMS, GULF AND EAST COASTS OF THE UNITED STATES**

Francis P. Ho, Richard W. Schwerdt, and Hugo V. Goodyear May 1975 97 p refs
(COM-75-11088/2; NOAA-TR-NWS-15; NOAA-75072305) Avail: NTIS HC $5.00 CSCL 04B

A climatology of hurricane factors important to storm surges is presented for the U.S. gulf and east coasts. A smoothed frequency of tropical storms and hurricanes entering and exiting the coast and storms passing within 150 nautical miles of the coast during the period 1871-1973 is given. The central pressure for hurricanes and tropical storms and the radius of maximum winds and speed of forward motion for hurricanes were obtained from data analysis. Directions of landfalling hurricanes and tropical storms at the time they crossed the coast at selected points were also analyzed. The probability distribution of each factor is plotted and analyzed for each 50 nautical mile interval along the coast. Selected probability levels of each distribution are summarized, and smoothed variations along the coast were obtained by analysis. GRA

**N76-14727#** National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service.

**MARINERS WEATHER LOG. VOLUME 19, NUMBER 4, JULY 1975**

Elwyn E. Wilson, ed. Jul. 1975 75 p refs
(COM-75-90008/04; NOAA-75072212) Avail: NTIS MF $2.25; HC available to persons or agencies with a marine interest from the Environmental Data Service, Page Bldg. 1 (D762), 2001 Wisconsin Ave., N. W. Washington, D. C. 20235 CSCL 04B

Information is presented on tropical cyclones. It contains three articles: one on satellite imagery analysis of cyclone intensity, and two on tropical cyclone activity in the Pacific Ocean during 1974, one for the western North Pacific and one for the central North Pacific. Contained in these articles are tables, charts, and data on the various individual tropical cyclones that occurred and an explanation of the interpretation of meteorological satellite imagery. GRA

**N76-14728#** National Oceanographic Data Center, Rockville, Md. Center for Experiment Design and Data Analysis.

**BOMEX SYNOPTIC WEATHER ATLAS**

Feb. 1975 259 p
(COM-75-11041/1; NOAA-75070106) Avail: NTIS HC $9.00 CSCL 04B

The atlas presents synoptic charts as an aid to user of the BOMEX data. Included in the atlas are mercator projection charts for sea level the top of the Ekman laver, and 700-500 and 200-mb levels. Operational charts plotted at the National Hurricane Center in Miami, Florida, were used as a base. These were subsequently reanalyzed at the National Climatic Center, Asheville, North Carolina, to include final BOMEX shipboard data. Also, where reports were sparse or infrequent, knowledge of general climatology and persistence was incorporated for fuller coverage. The charts were reviewed to improve continuity in time. GRA

**N76-14729#** National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.

**CORRECTION OF BOMEX RADIOSONDE HUMIDITY ERRORS**

L. D. Sanders, J. T. Sullivan, and P. J. Pytlowany May 1975 16 p refs
(COM-75-10992/6; NOAA-TM-EDS-BOMAP-16; NOAA-75062008) Avail: NTIS HC $3.50 CSCL 04B

During the Barbados Oceanographic and Meteorological Experiment (BOMEX) in 1969, rawinsonde soundings indicated a large diurnal variation in relative humidity. Comparison with other measurement systems showed that values were as much as 25% too low at midday. The primary source of error was found to be deficient design of the duct that housed the carbon-coated hygristor, resulting in heating of the sensor by solar radiation. To correct this error, the daytime average ambient vapor pressure for a 7-day period was assumed to be the same as the nighttime average. After applying the correction for radiation, and taking into account the known lag properties of the hygristor, the corrected relative humidities were found in most cases to be within 5% or less of the actual value. GRA

**N76-14730#** Hawaii Univ., Honolulu. Water Resources Center.

**METHODOLOGICAL APPROACHES IN HAWAIIAN FOG RESEARCH**

James McKnight and James O. Juvik Mar. 1975 40 p
(Contract DI-14-31-0001-4011)
(PB-243508/9; TR-85; OWRT-A-041-HI(1)) Avail: NTIS HC $4.00 CSCL 04B

Recent studies have demonstrated the important moisture contribution from fog precipitation and mountain areas on the island of Hawaii. Research methodologies useful in the study of Hawaiian upslope fog, were investigated, including; (1) development of an improved fog gage; (2) development of indirect approximation methods for estimating average droplet sizes during precipitation episodes and separating fog and rainfall components; (3) establishment of an extensive fog sampling network on the island of Hawaii employing continuous recording equipment, for both rain, fog, and wind; (4) development of an original computer program for detailed temporal and spatial analysis of rain, fog, and wind parameters. GRA

**N76-14529*** University Corp. for Atmospheric Research, Boulder, Colo.

**RELATIONSHIPS BETWEEN SOLAR ACTIVITY AND CLIMATE CHANGE**

Walter Orr Roberts *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 13-24 refs (For availability see N76-14528 05-42)
CSCL 04B

**N76-14530*** Stanford Univ., Calif.

**SOLAR ACTIVITY AND THE WEATHER**

John M. Wilcox *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 25-38 refs (For availability see N76-14528 05-42)
CSCL 04B

**N76-14532*** Australian Embassy, Washington, D.C.

**KIDSON'S RELATION BETWEEN SUNSPOT NUMBER AND THE MOVEMENT OF HIGH PRESSURE SYSTEMS IN AUSTRALIA**

E. G. Bowen *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 43-45 refs (For availability see N76-14528 05-42)
CSCL 04B

**N76-14536*** Northrop Services, Inc., Houston, Tex.

**A SPECTRAL SOLAR/CLIMATIC MODEL**

H. Prescott Sleeper, Jr. *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 71-78 refs (For availability see N76-14528 05-42)
(Contract NAS8-21810)
CSCL 04B

**N76-14537*** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**A POSSIBLE CORRELATION BETWEEN MAXIMA OF THE FAR ULTRAVIOLET SOLAR IRRADIANCE AND CENTRAL MERIDIAN PASSAGES OF SOLAR MAGNETIC SECTOR BOUNDARIES**
Donald F. Heath and John M. Wilcox (Stanford Univ.) *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 79-81 refs (For availability see N76-14528 05-42)
CSCL 04B

**N76-14539*** Lockheed Missiles and Space Co., Palo Alto, Calif.
**DIRECT SATELLITE OBSERVATIONS ON BREMSSTRAHLUNG RADIATION AS A TECHNIQUE TO INVESTIGATE ITS ROLE IN METEOROLOGICAL PROCESSES**
R. G. Johnson and W. L. Imhof *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 89-94 refs Sponsored by ONR (For availability see N76-14528 05-42)
CSCL 04B

**N76-14542*** Harvard Coll. Observatory, Cambridge, Mass.
**SOLAR MODELS IN RELATION TO TERRESTRIAL CLIMATIC VARIATIONS**
A. G. W. Cameron *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 143-147 refs (For availability see N76-14528 05-42)
CSCL 04B

**N76-14547*** State Univ. of New York, Stony Brook.
**SOLAR MODULATION OF ATMOSPHERIC ELECTRIFICATION THROUGH VARIATION OF THE CONDUCTIVITY OVER THUNDERSTORMS**
Ralph Markson *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 171-178 refs (For availability see N76-14528 05-42)
CSCL 04B

**N76-14549*** Rice Univ., Houston, Tex.
**SOME PROBLEMS IN COUPLING SOLAR ACTIVITY TO METEOROLOGICAL PHENOMENA**
A. J. Dessler *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 187-197 refs (For availability see N76-14528 05-42)
(Grant NGL-44-006-012)
CSCL 04B

**N76-14550*** National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
**NUMERICAL EXPERIMENTS ON SHORT-TERM METEOROLOGICAL EFFECTS ON SOLAR VARIABILITY**
R. C. J. Somerville, J. E. Hansen, P. H. Stone, W. J. Quirk, and A. A. Lacis (Computer Sciences Corp.) *In its* Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 199-211 refs (For availability see N76-14528 05-42)
CSCL 04B

# 48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

**N76-14731** Texas A&M Univ., College Station.
**ANALYSIS OF TOTAL SUSPENDED MATTER IN THE CARIBBEAN SEA Ph.D. Thesis**
Nelson Jay Bassin 1975 118 p
Avail: Univ. Microfilms Order No. 75-25082

Total suspended matter (TSM) in the Caribbean was determined quantitatively by means of filtration through prepared 0.45 micrometer membrane filters. Results indicate that there is no gravimetrically-detectable nepheloid layer in the Caribbean. The bulk of the matter is introduced to the Caribbean through the passages of the Lesser Antilles, probably as discharge from the Amazon and Orinoco Rivers. The generally low productivity of the Caribbean results in an unusually high ratio of mineral matter over planktonic detritus. A broad TSM high extends northward from the South American coast, apparently related to northward advection at the confluence of the westerly Caribbean Current and an eastward-flowing coastal counter current. Subsurface advection and diffusion studies indicate that particulate material distribution is accounted for by transport from the sills, with resuspension in the deep basins as a minor contributor.
Dissert. Abstr.

**N76-14732** Washington Univ., Seattle.
**BERING SEA WATER ON THE NORTH ALASKAN SHELF Ph.D. Thesis**
David Gould Mountain 1975 166 p
Avail: Univ. Microfilms Order No. 75-28407

The flow of water from the Bering Sea onto the North Alaskan shelf is described through analysis of hydrographic and current measurements. The water motions in both Barrow Canyon and on the North Alaskan shelf are considered. Factors discussed include: variations in current velocities; atmospheric pressure effects; temperature gradients; salinity; and upwelling.
Dissert. Abstr.

**N76-14733#** Oregon State Univ., Corvallis. Corvallis School of Oceanography.
**EXPOSURE, A NEWSLETTER FOR OCEAN TECHNOLOGISTS. VOLUME 3, NUMBER 3**
Roderick Mesecar, ed. Jul. 1975 14 p
(Contract N00014-67-A-0369-0007; NR Proj. 083-102)
(AD-A013654) Avail: NTIS CSCL 08/10

Contents: Underwater optical target; A lightweight profiling system; A small drifting buoy for a moderately severe environment.
GRA

**N76-14734#** Woods Hole Oceanographic Institution, Mass.
**DESCRIPTIONS OF WHOI SEDIMENT CORES, VOLUME 1**
D. A. Johnson, ed. and A. H. Driscoll, ed. May 1975 184 p 4 Vol.
(Contract N00014-74-C-0262; Grant NSF DES-73-06463; NR Proj. 083-004)
(AD-A013997; WHOI-75-8-Vol-1) Avail: NTIS CSCL 08/7

The report presents visual core descriptions and smear slide analyses for all cores in the Woods Hole Oceanographic Institution geological samples collection which were obtained prior to November 1973. Approximately 1000 coring stations from the Atlantic, Indian and Pacific oceans and adjacent seas are represented. Charts of ships' track and computer listings of all cores are also included.
GRA

**N76-14735#** Woods Hole Oceanographic Institution, Mass.
**DESCRIPTIONS OF WHOI SEDIMENT CORES, VOLUME 2**
D. A. Johnson, ed. and A. H. Driscoll, ed. May 1975 479 p 4 Vol.
(Contract N00014-74-C-0262; Grant NSF DES-73-06463; NR Proj. 083-004)
(AD-A013998; WHOI-75-8-Vol-2) Avail: NTIS CSCL 08/7
For abstract, see N76-14734.

**N76-14736#** Woods Hole Oceanographic Institution, Mass.
**DESCRIPTIONS OF WHOI SEDIMENT CORES, VOLUME 3**
D. A. Johnson, ed. and A. H. Driscoll, ed. May 1975 458 p 4 Vol.
(Contract N00014-74-C-0262; Grant NSF DES-73-06463; NR Proj. 083-004)
(AD-A013999; WHOI-75-8-Vol-3) Avail: NTIS CSCL 08/7
For abstract, see N76-14734.

**N76-14737#** Woods Hole Oceanographic Institution, Mass.
**DESCRIPTIONS OF WHOI SEDIMENT CORES, VOLUME 4**
D. A. Johnson, ed. and A. H. Driscoll, ed. May 1975 459 p 4 Vol.
(Contract N00014-74-C-0262; Grant NSF DES-73-06463; NR Proj. 083-004)
(AD-A014000; WHOI-75-8-Vol-4) Avail: NTIS CSCL 08/7
For abstract, see N76-14734.

**N76-14738#** Scripps Institution of Oceanography, La Jolla, Calif. Advanced Ocean Engineering Lab.

**MARINE PHYSICS, INTERNAL WAVES AND MICROSTRUCTURE Technical Progress Report, 1 Jan. - 30 Jun. 1975**
James L. Cairns, Gordon O. Williams, Charles S. Cox, and R. E. Lange 30 Jun. 1975 13 p refs
(Contract N00014-75-C-1034; ARPA Order 2185; NR Proj. 260-105)
(AD-A013665; AOEL-73; SIO-Rec-75-22) Avail: NTIS CSCL 08/3

This semi-annual report reflects the technical status of internal wave and microstructure studies conducted within this laboratory. GRA

**N76-14739#** Naval Undersea Center, San Diego, Calif. Biosystems Research Dept.
**FASOR 2: CORRELATIVE BIOLOGICAL AND ACOUSTICAL STUDIES IN THE NORTH PACIFIC OCEAN Interim Technical Report**
Peter F. Seligman and William A. Friedl Jan. 1975 99 p refs (SR1040301; ZR0110801)
(AD-A013636; NUC-TP-448) Avail: NTIS CSCL 08/1

An experimental analysis of acoustic and biological measurements collected during a Forward Area Sonar Research (FASOR) Cruise in the North Pacific Ocean (Feb. through Jul. 1966) is presented. Specifically, the relationship among biological samples, acoustical phenomena of echo groups, 12 kHz scattering layers, and 3 and 12 kHz volume scattering measurements, and water mass characteristics is investigated. Studies delineate eight oceanic regions as distinctive in biological and acoustic character (signature). General results are discussed. GRA

**N76-14740#** Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
**HYDRAULIC CONSTANTS OF TIDAL ENTRANCES. 2: STABILITY OF LONG ISLAND INLETS**
A. J. Mehta and H. S. Hou Nov. 1974 104 p refs
(Contract N00014-68-A-0173-0020; NR Proj. 388-106)
(AD-A004992; TR-23) Avail: NTIS CSCL 08/3

The susceptibility of a tidal inlet to closure involves a consideration of two opposing agencies: (a) the onshore wave energy which tends to drive littoral material towards the entrance and (b) the tidal flow which attempts to scour this material to keep the entrance channel open. This concept is explored with reference to the stability of the inlets on the south shore of Long Island. A generalized criterion for stability is proposed, and it is found that this criterion can be used to classify inlets ranging in size from a laboratory model to large natural entrances. GRA

**N76-14741#** Woods Hole Oceanographic Institution, Mass.
**W.H.O.I./BROWN CTD MICROPROFILER, METHODS OF CALIBRATION AND DATA HANDLING**
N. P. Fofonoff, S. P. Hayes, and R. C. Millard, Jr. Dec. 1974 70 p refs
(Contract N00014-74-C-0262; Grant NOAA-03-4-022-31; NR Proj. 083-004)
(AD-A004197; WHOI-74-89) Avail: NTIS CSCL 08/10

Calibration techniques developed for the WHOI/Brown CTD are described. Comparison is made with classical methods of hydrography for stations obtained in the mode-1 density program. Methods for temperature lag correction and conversion conductivity to salinity are given. GRA

**N76-14742#** Naval Postgraduate School, Monterey, Calif.
**THE EFFECT OF A PLANE BOUNDARY ON WAVE INDUCED FORCES ACTING ON A SUBMERGED CYLINDER M.S. Thesis**
Houston Keith Jones Jun. 1975 47 p refs
(AD-A013608) Avail: NTIS CSCL 13/11

The in-line and transverse forces acting on cylinders of 1.0 inch to 2.5 inches diameter placed near a plane wall in a harmonically oscillating flow have been measured. The drag and inertia coefficients C sub d and C sub m for the in-line force and the lift coefficients C sub 1A and C sub 1T for the transverse forces away and toward the wall, respectively, have been determined as a function of the relative gap e/D between the wall and the cylinder and the period parameter V sub m T/D. The relative gap ranged from 0.0143 to unity and the period parameter from zero to 35. In the subcritical range where these experiments have been performed, the effect of the Reynolds number, which ranged from 4,000 to 30,000, was found to be secondary and certainly obscured by the excellent correlation provided by the period parameter. The frequency of the transverse force was found to range from one to five times the frequency of oscillation of the harmonic motion, but a dominant frequency of twice the oscillation frequency was seen over most of the values of V sub m T/D. GRA

**N76-14743#** Inter-American Tropical Tuna Commission, La Jolla, Calif.
**APPLICATION OF SATELLITE DATA TO PROBLEMS IN FISHERY OCEANOGRAPHY Final Report**
Merritt R. Stevenson and Forrest R. Miller May 1975 108 p refs
(Grant NOAA-04-4-158-28)
(COM-75-11049/4; NOAA-75070803) Avail: NTIS HC $5.50 CSCL 06C

Results are described on methods of data processing and on the feasibility of using VHRR data to obtain SST's for an oceanic region off northwest Africa and in the Gulf of California. A comparison of VHRRIR and SRIR (GOSSTCOMP) data from several passes over the ocean off northwest Africa suggests that it is possible to calibrate VHRRIR data on the average to within about 1 degree C of ground truth, compared to about 1-2.5 degrees C for the GOSSTCOMP data. For the Gulf of California region, the VHRRIR and the GOSSTCOMP data were within about 2.5 degrees C of ground truth measured from a research vessel working in the area. Meteorological conditions in both study areas are discussed using vertical profiles of moisture, mixing ratio, etc. Also discussed is the manner in which the changing meteorological conditions affect integrated moisture values in the overlying marine layer. The feasibility of using remotely sensed data from NOAA and ERTS satellites in an integrated data system is briefly described. GRA

## 51 LIFE SCIENCES (GENERAL)

Includes genetics.

**N76-14744** Temple Univ., Philadelphia, Pa.
**THE FEASIBILITY OF USING PHYTOPLANKTON IN A QUANTITATIVE METHOD OF DETECTING LOW LEVELS OF RADIONUCLIDES Ph.D. Thesis**
Thomas Allen Jenckes 1975 134 p
Avail: Univ. Microfilms Order No. 75-28226

The use of phytoplankton as a bioconcentrator for measuring low levels of radionuclides in water is reported. Green unicellular algae were selected due to their ability to yield high concentration factors. Results show that the algal system can be used to quantify unknown radionuclide levels, but that the method is not a practical choice. Dissert. Abstr.

**N76-14745** Washington Univ., Seattle.
**AN ECOLOGICAL STUDY OF CERTAIN BLUEGREEN ALGAE IN FOUR SEATTLE-AREA LAKES Ph.D. Thesis**
Abraham Johannes Hendrik Pieterse 1974 358 p
Avail: Univ. Microfilms Order No. 75-28415

A comparative study of four Seattle area lakes was undertaken for a one year period. The chemical and physical conditions in the lakes were studied on a weekly basis and compared with changes in phytoplankton populations and abundance. Common and repeatable or unique trends in the characteristics of the bluegreen algae populations were identified, and from these trends, postulates are made to explain the mechanisms of the trends in order to relate the bluegreen algae to environmental conditions under which they live in nature. The results indicated that metalimnetic growth of phytoplankton species is relatively common in lakes with a relatively shallow epilimnion and these populations determine the qualitative and quantitative status of the phytoplankton populations of the surface water. This may be a primary reason why the principle of competitive exclusion cannot be applied to the phytoplankton of some lakes. Dissert. Abstr.

**N76-14746** Washington Univ., Seattle.
**PHYSICAL CHARACTERIZATION OF PHYCOBILIPROTEINS**

**FROM BLUEGREEN ALGAE Ph.D. Thesis**
Masanori Kato 1975 132 p
Avail: Univ. Microfilms Order No. 75-28373

The 10S oligomer of phycocyanin from Phormidium luridum has been isolated and purified by ammonium sulfate fractionation and a series of gel chromatographies. The protein is characterized by its sedimentation constant 10.2S, the diffusion constant 4.73 x 10/7 sq cm/sec, and intrinsic viscosity 3.89 ml/g. The molecular weight of the oligomer is calculated to be 209,000. The shape and dimensions of the hexamer are discussed in terms of a model consisting of subunits arranged with C sub 6 symmetry. The monomer, assumed to be spherical, is found to have a radius of 22 A, and the diameter across the hexamer is 132 A. The latter figure agrees closely with dimensions observed in electron micrographs. Dissert. Abstr.

**N76-14747** American Univ., Washington, D.C.
**HIGH-PURITY, BACTERIA-FREE AND ENDOTOXIN-FREE WATER Ph.D. Thesis**
Narbik A. Karamian 1975 129 p
Avail: Univ. Microfilms Order No. 75-28935

A spectrophotometric method was developed for assaying endotoxins at levels as low as 10 ppb. Five different endotoxins, E. coli 0127:B8, E. coli 055:B5, S. abortus equi, S. enteritidis and S. flexneri were tested. It was demonstrated that membranes made from solutions of 18 wt. % cellulose acetate, 24 wt. % water and 58 wt. % 1,4-dioxane can reject 98.5% of the endotoxins from aqueous solutions containing ppm levels of the contaminant at operating pressures as low as 50 psi. These membranes exhibited an average flux of 108.3 gal/day-sq ft under these conditions. The following factors were examined for their contributions to the membrane flux and endotoxin rejection properties: casting solution composition and viscosity, temperature and composition of quenching medium, membrane thickness, and percolating time. The practical advantages of making membranes from the above formulation are discussed. A simple and self-regulated all-glass automatic distillation apparatus for preparing and storing high-purity, bacteria-free and endotoxin-free water was constructed. The components of the system, the operating procedure and cleaning and sterilizing methods are fully described. The results of chemical and bacteriological tests of the apparatus are presented. Dissert. Abstr.

**N76-14748#** Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
**THE EXCRETION OF GLYCOLATE BY CHLOROGONIUM ELONGATUM DANGEARD**
H. Stabenau 1975 14 p refs Transl. into ENGLISH from Biochemie und Physiol. der Pflanzen (West Ger.), v. 163, no. 1, 1972 p 42-51
(NRC/CNR-TT-1831) Avail: NTIS HC $3.50

Experiments on chlorogonium elongatum to determine the conditions under which the cells excrete glycolate are reported. The materials and methods, and results are described. It was found that the highest rate of excretion resulted from aeration with pure oxygen. Under these conditions the starch content of the cells decreased. An increase in the partial pressure of CO2 reduced the excretion of glycolate. With 2 voi. % CO2 in the aeration mixture no acid excretion was detected. Glycolate was excreted in red as well as in blue light, the rate of excretion being somewhat higher in blue light. F.O.S.

**N76-14749#** Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
**ANIMAL BEHAVIOUR AND CIRCADIAN RHYTHMS**
V. B. Chernyshev 1975 18 p refs Transl. into ENGLISH from Zh. Obshch. Biol. (Moscow), v. 34, no. 2, 1973 p 284-293
(NRC/CNR-TT-1829) Avail: NTIS HC $3.50

The behavior of various animals is analyzed with them transferred from a natural rhythmic environment to a constant environment. It is suggested that the parameters of the circadian rhythm depend on the experimental conditions. Author

**N76-14750*#** Transemantics, Inc., Washington, D.C.
**CONSERVATION OF ENERGETIC BALANCE AS A BASIS OF ADAPTION PROCESS**
N. I. Kalabukhov Washington NASA Dec. 1975 36 p refs Transl. into ENGLISH from Zh. Obshch. Biol. (USSR), v. 7, no. 6, 1946 p 417-433
(Contract NASw-2792)
(NASA-TT-F-16686) Avail: NTIS HC $4.00 CSCL 06C

The author proposes the hypothesis that adaptation of an organism occurs by means of regulating the influx or loss of energy, thereby leading to supporting the energetic balance of the organism. Author

## 52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

**N76-14751** California Univ., Los Angeles.
**A STUDY OF THE ELECTRICAL PROPERTIES OF THE TRANSVERSE TUBULAR SYSTEM IN SKELETAL MUSCLE Ph.D. Thesis**
Richard Tacke Mathias 1975 121 p
Avail: Univ. Microfilms Order No. 75-26967

The linear electrical properties of muscle cells were studied. A new model for the transverse tubules was derived. This model is tested on various actual networks and shown to be valid, it is shown that the previous model for the T-system fails to fit actual networks. New circuit parameters for muscle fibers from experimental data are derived when the resistivity of the lumen of the tubules now being equal to the resistivity of the bathing solution. The new model for the transverse tubular system is derived assuming each branch of the T-system is a miniature transmission line which can be described by standard two port theory. The points where these branches join are considered nodes in a deterministic network, this network possessing either three or four branches per node. These assumptions allow one to write a set of linear partial difference equations for the potential at each node. Dissert. Abstr.

**N76-14752** Temple Univ., Philadelphia, Pa.
**AUTOREGULATION IN THE MICROVESSELS OF SKELETAL MUSCLE Ph.D. Thesis**
Ronald Frank Tuma 1975 165 p
Avail: Univ. Microfilms Order No. 75-28254

The control mechanisms in the microcirculation of tenuissimus muscles of cats and rabbits were studied. Changes in capillary blood flow were determined by measuring the transient time of red blood cells between two photosensing windows by using a cross correlator computer. Evidence indicated that there is no specific branching order of the arterial vessels in the tenuissimus muscle which functions as a precapillary sphincter. It was also determined that blood flow distribution was not homogeneous, that tissue oxygen tension influenced the rate of capillary blood flow, and that the initial hyperemia produced after removal of arterial occlusion was not due to hypoxia. Dissert. Abstr.

**N76-14753** Tennessee Univ., Knoxville.
**ENERGY COSTS OF SPECIFIC CUSTODIAL WORK TASKS Ph.D. Thesis**
Joe Foust Smith 1975 57 p
Avail: Univ. Microfilms Order No. 75-26737

Energy costs for various work tasks performed by custodial work crews were considered. The data should provide information which would be of value to physicians in determining the degree of danger this particular occupation may hold for coronary patients returning to work. The subjects were seven male employees who performed custodial work tasks. Nine work tasks that were representative of the normal work activities of the crew were selected for measurement. Oxygen consumption and heart rate were the two parameters measured. Energy costs were determined from the oxygen consumption values and were expressed in several different units for comparison. The average energy requirements of the various work tasks ranged from 3.4-6.4 kcal per minute with the largest value resulting from dust mopping the arena floor. Dissert. Abstr.

**N76-14754** California Univ., Los Angeles.
**IN VIVO ANALYSIS OF COMPACT BONE STRUCTURE Ph.D. Thesis**

David Solomon Wishko 1975 150 p
Avail: Univ. Microfilms Order No. 75-27008

The strength of cortical bone structure is assessed in vivo through the utilization of three independent measurements made on normals and patients. The first was the photon absorption technique which was used to determine the bone mineral content and the overall diameter of the bone. The second was measurement of the speed of ultrasound through the transverse direction of the cortical bone, and the third was a radiograph of the bone to determine the cortical thickness. Through the use of these methods, quantitative measurement of bone mineral content and the speed-of-sound was obtained. In addition, with the use of a bone model additional properties, e.g., modulus of elasticity, compact bone density, bone mineral density and percent ash content were derived. Dissert. Abstr.

**N76-14755** British Library Lending Div., Boston Spa (England).
**RELATIONS BETWEEN RADIATION DOSE AND SOMATIC RADIATION RISK**
V. W. Jacobi [1975] 17 p refs Transl. into ENGLISH from Atomwirtschaft (Duesseldorf), Jun. 1974 p 278-283
(BLL-CE-Trans-6697-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

Results are described in radiation biology which indicate that with exposure to soft ionizing radiation a nonlinear dose-response relation is very much more probable than a linear relation. This finding is of great importance, since both occupational radiation exposure and also the radiation exposure of the population is caused almost exclusively by this type of radiation. Risk analyses show that in the lower dose range the carcinogenic effect of X-rays, gamma rays, and beta-rays is substantially less than has been assumed. It is concluded that in the dose range below 50 rad the real mean radiation cancer risk to be expected is probably no greater than 0.0001% per rad. Author

**N76-14756** Washington Univ., Seattle.
**AN ULTRASONIC SYSTEM FOR MEASUREMENT OF VESSEL CROSS SECTION Ph.D. Thesis**
Roy Wallace Martin 1975 322 p
Avail: Univ. Microfilms Order No. 75-28395

A prototype system is described to measure arterial sectional area. The instrument is a portion of a total system to ultimately measure cardiac flow continuously. The sensors of the system consist of an array of ultrasonic transducers mounted on the tip of a 2 mm outside diameter catheter. An analysis of the flow and area measurement problem is presented. The developed electronic scanning system which operates the transducer array is described in detail. In vitro and in vivo tests of the unit have demonstrated the feasibility of the sectional area measurement portion of the system. A review of pulse-echo systems utilizing radar theory is included. Dissert. Abstr.

**N76-14757*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**MEDICAL SUBJECT MONITORING SYSTEMS Patent**
Garry J. Cleveland (LMSC, Sunnyvale, Calif.), George M. Loh (LMSC, Sunnyvale, Calif), Robert S. Lunce (LMSC, Sunnyvale, Calif.), Norman Belasco, Marko I. Lipanovich (LMSC, Sunnyvale, Calif.), Howard E. Peterssen (LMSC, Sunnyvale, Calif.), Sam L. Pool, and Donald W. Mangold, inventors (to NASA) (Boeing Co., Pasadena, Tex.) Issued 7 Oct. 1975 12 p Field 25 Apr. 1973 Supersedes N73-22045 (11 - 13, p 1486)
(NASA-Case-MSC-14180-1; US-Patent-3,910,257; US-Patent-Appl-SN-354406; US-Patent-Class-128-2.1A; US-Patent-Class-128-2H; US-Patent-Class-128-2.06R) Avail: US Patent Office CSCL 06B

Medical monitoring systems allowing the monitored subject freedom of movement are described. The outputs of the sensors are suitably amplified and conditioned to provide the necessary voltage levels for the multiplexers in the analog-to-digital (A/D) converters. The measured phenomena are displayed at a remote monitoring and control station. The entire system includes a bio-belt linked by optically coupled transmission and reception links to a data acquisition unit (DUA) having a central station function of controlling and displaying the output from the bio-belt. Official Gazette of the U.S. Patent Office

**N76-14758#** Advisory Group for Aerospace Research and Development, Paris (France).
**AEROMEDICAL IMPLICATIONS OF RECENT EXPERIENCE WITH COMMUNICABLE DISEASE**
R. E. Mammen, ed. (Naval Aerospace and Regional Med. Center, Pensacola, Fla.) Sep. 1975 88 p refs Conf. held at Toronto, Canada, 7-8 May 1975
(AGARD-CP-169) Avail: NTIS HC $5.00

Epidemiology, detection and diagnosis, treatment and prevention of infectious diseases of aeromedical interest are discussed. For individual titles, see N76-14759 through N76-14773.

**N76-14759** Institut fuer Wehrmedizin und Hygiene, Koblenz (West Germany).
**EPIDEMIOLOGIC RISK FACTORS OF FLUSH-RECYCLE TOILETS IN AIRCRAFT**
Wolfgang H. Fischer *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 2 p (For availability see N76-14758 05-52)

In connection with emergency air transports from areas of low hygienic standards and presence of important infectious diseases, laboratory tests and field trials disclosed a number of serious hygienic deficiencies which were taking an exceedingly critical course during middle range and long distance flights and also by exposal of ground servicing personal and vehicles to infectious waste material. It is shown that toilet sanitation systems presently used in airliners do not meet the standards required for the health of air crews and passengers. Commonly used sanitary fluids for toilet operation are presented and their quality discussed. Recommendations are given to improve the aircraft toilet sanitation. Author

**N76-14760** Air France, Paris. Service Medical Central.
**TRANSPORTATION OF PASSENGERS WITH CONTAGIOUS DISEASES ON AIRLINERS [LE TRANSPORT DES MALADES CONTAGIEUX EN AVION DE LIGNE]**
Michel Perin *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 8 p refs In FRENCH; ENGLISH summary (For availability see N76-14758 05-52)

The problems related to the transportation of passengers with contagious diseases on airliners were discussed. It was pointed out that the refusal of most airlines to transport such passengers can scarcely be justified by reference to either laws or regulations; it introduces the risk of arbitrary, mistaken, or prejudiced conduct and it can cause serious harm to certain patients. It also does not seem logical since airlines learn about only a small fraction of the contagious persons who travel, and public health is much more greatly endangered by unknown contagious persons. It was concluded that airlines should continue to refuse to transport only those passengers having diseases characterized by vomiting or serious diarrhea or transmitted through the air, if it is impossible by simple means to avoid the risk of contaminating other travellers and flight crew members who might be receptive. Author

**N76-14761** Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany).
**FOOD POISONING OBSERVED WITH AIRPLANE CREW AND PASSENGERS DEPENDING ON AIRPLANE OPERATIONS**
R. Schubert *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 3 p refs (For availability see N76-14758 05-52)

Many food poisonings can more easily be caused during air plane operations. They can create even more serious problems than on earth. In this connection they can be caused during the flight if it is of long duration and even bring about the symptoms of the illness. More frequently, however, they have been acquired before. Sometimes a gastrointestinal disturbance, the traveller's disease, can be observed appearing like a food poisoning without being such in the original sense. On flights from certain regions of the globe, especially from the Far East, one must expect cases of food poisoning in the air traffic more often than from other countries. Author

**N76-14762** Bayerische Landesimpfanstalt, Munich (West Germany).

**IMPORTATION, DIAGNOSIS AND TREATMENT OF SMALLPOX, CHOLERA AND LEPROSY**

H. Chr. Huber, V. Hochstein-Mintzel, and H. Stickel *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 4 p refs (For availability see N76-14758 05-52)

Since 1957 a total of 11 cases of smallpox have been introduced into the FRG. The final diagnosis was usually delayed until the 10th day after the onset of clinical symptoms. The diagnosis of variola must be supported by epidemiological data and laboratory tests. Epidemiological data refer to travel in endemic areas, the probability and time of contact, and the resulting incubation period. Laboratory examination is usually restricted to three tests: serological examination for hemagglutination inhibiting antibodies, electron microscopy of skin scrapings, and virus isolation on the chorioallantoic membrane of embryonated eggs. The importation of cholera and leprosy bears minor problems as to the possible spread of the diseases. Introduction of cholera cannot be avoided by public health measures. An endemic spread, however, does not need to be considered in countries of appropriate standards of public hygiene. The prognosis of the disease is quite favorable, provided that proper therapy is initiated in the early stages. Author

**N76-14763** Deutsche Lufthansa Aktiengesellschaft, Frankfurt am Main (West Germany).

**TRANSPORTATION BY AIR OF A LASSA FEVER PATIENT IN 1974**

Horst H. Renemann *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 5 p refs (For availability see N76-14758 05-52)

Lassa fever, also known as arenavirus disease and Casals' disease, was recognized for the first time in 1969 in Lassa, Nigeria. Its fatality ratio has been high in clinically observed cases; 10 out of 22 infected physicians and medical workers died of it. The person-to-person transmission probably takes place when airborne viruses from the sore mucous membrances in the mouth and pharynx are expelled by breathing, talking and coughing. A German patient with arenavirus, Dr. Mandrella, was transported from Nigeria to Germany in March 1974, by Condor Boeing 707-430 manned by a volunteer flight crew of Lufthansa. The special preparation of the plane to prevent transmission of airborne viruses to the flight crew and other measures taken against contamination will be described. Author

**N76-14764** Air Transport Command, Trenton (Ontario).

**LASSA FEVER: TO AIR EVACUATE OR NOT**

A. J. Clayton *In* AGARD Aeromedical Implications of Recent Experience with Communicable Diseases Sep. 1975 4 p refs (For availability see N76-14758 05-52)

The clinical features of Lassa Fever are briefly discussed and the epidemiology of the disease is outlined with respect to the five recorded outbreaks between 1969 and 1974. The Canadian Government having become involved in two potential air evacuations of patients from West Africa is concerned over the risks to medical flight teams and receiving hospital personnel in the event of cases of Lassa Fever being repatriated to Canada. A survey is being carried out on Canadian Forces long range transport aircraft to study the microbiological environment within two types of aircraft during flights by dispersing non-pathogenic organisms. The objective is to determine the optimum location for a patient with a highly infectious disease and to ensure minimal transmission of organisms. Author

**N76-14765** School of Aerospace Medicine, Brooks AFB, Tex. Epidemiology Div.

**INTERNATIONAL QUARANTINE FOR CONTROL OF MOSQUITO-BORNE DISEASES ON GUAM**

Wesley R. Nowell *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 8 p refs (For availability see N76-14758 05-52)

The initial mosquito survey of Guam conducted in 1936 revealed the presence of five indigenous species. Subsequent surveys showed a steady climb to fifteen species in 1969, and a dramatic jump to thirty-five by 1972. Japanese B encephalitis, and filariasis, five primary mosquito-borne diseases known to occur on Pacific islands, have been found on Guam, and trends of the diseases are emphasized. The Island of Guam is centrally located in the Western Pacific and aircraft are implicated in the introductions of new mosquito species. Chronic problems associated with aircraft quarantine inspections and insect control procedures are described, and methods to curb the introduction of new mosquito species and their associated diseases are discussed. Author

**N76-14766** School of Aerospace Medicine, Brooks AFB, Tex. Epidemiology Div.

**AN EPIDEMIC OF CHIKUNGUNYA IN THE PHILIPPINE ISLANDS: POSSIBLE ROLE OF AIRCRAFT DISSEMINATION**

George D. Lathrop and Paul J. Homme *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 6 p refs (For availability see N76-14758 05-52)

Twin outbreaks of chikungunya, a Group A arbovirus, are analyzed that occurred on the Island of Negros, Republic of the Philippines during 1968-1969. Epidemiologic data derived from interviews, serologic, and virologic testing showed that young and middle aged people were immunologically susceptible, and that the disease was transmitted in three week waves by the mosquito, Aedes albopictus. Inferential evidence suggested that acquired immunity due to an apparent 1920 chikungunya epidemic accounted for a lower attack rate in the elderly population. Chikungunya was probably introduced into Negros by aircraft or ships from Manila, where a smaller outbreak had been documented in 1967-1968. The outbreaks on Negros subsided naturally prior to increased mosquito abatement and public health control measures. Unconfirmed clinical evidence suggested that the disease was disseminated into the adjacent islands of Cebu and Mindanao. Author

**N76-14767** Bayerische Landesimpfanstalt, Munich (West Germany).

**THE ATTENUATED LIVE SMALLPOX VACCINE, STRAIN MVA RESULTS OF EXPERIMENTAL AND CLINICAL STUDIES**

V. Hochstein-Mintzel, H. Stickel, A. Mayr, H. Chr. Huber, H. Schaefer, and A. Holzner *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 5 p refs Prepared in cooperation with Inst. fuer Mikrobiol., Muenchen (West Germany) (For availability see N76-14758 05-52)

In an attempt to basically alter and improve smallpox vaccination, the use of an attenuated strain of vaccinia virus was proposed. Attenuation was effected through more than 500 continuous passages in chick embryo fibroblast cultures. Animal experiments showed the complete absence of neurovirulence for the attenuated strain. The favorable experimental results led to a field study of primary vaccinations in the human. The recommended procedure was to administer 0.1 ml of attenuated vaccine intradermally, followed by conventional cutaneous smallpox vaccination 7 to 28 days later. The results may be summarized as follows: the local reaction to the attenuated vaccine merely amounted to slight reddening and infiltration at the site of injection with complete absence of typical vaccinal lesions. Untoward systemic reactions were not observed. The subsequent cutaneous vaccination resulted in 84% major reactions and 9% equivocal reactions. Seven percent remained negative. 78% of the takes were of the accelerated type, giving evidence of the immunizing capacity of the attenuated strain. Author

**N76-14768** Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

**COCCIDIOIDOMYCOSIS AND AVIATION**

G. Apel and V. Grouls *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 3 p refs Prepared in cooperation with Inst. of Pathol., Bonn-Venusberg (West Germany) (For availability see N76-14758 05-52)

In the age of transatlantic travel and mass tourism it can not be precluded that Coccidioidomycosis will be brought to areas on the globe in which this disease has hitherto been unknown. Since the incubation period will last two to three weeks and occasionally also four weeks, the disease will frequently occur only after air passengers have long returned to their home countries. Considering the striking similarity with the clinical picture

of pulmonary tuberculosis, it is not surprising that in Europe the disease is diagnosed as tuberculosis, even more so since tuberculination may often be positive. The patients are then subjected to an anti-tuberculous therapy, which necessarily must remain without success in such cases. If an exact case history including travels abroad and residences in endemic areas of Coccidioidomycosis can be established, a clue pointing to the true nature of the disease may be obtained. Author

**N76-14769** Institute of Aviation Medicine, Fuerstenfeldbruck (West Germany).

**THE INDUCTION OF INTERFERON AND SPECIFIC SMALLPOX IMMUNITY BY ORAL IMMUNIZATION WITH LIVE ATTENUATED POX VIRUS**

V. Hochstein-Mintzel, A. Mayr, and H. Stickl *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 5 p refs Prepared in cooperation with Inst. fuer Mikrobiol., Muenchen (West Germany) (For availability see N76-14758 05-52)

In the human, oral immunization with live attenuated virus was effected by the administration of virus-containing tablets. The procedure caused no untoward effect in primary vaccines. Subsequent skin testing and conventional cutaneous vaccination resulted in accelerated takes, demonstrating successful oral pre-immunization. Attenuated heterologous pox virus was shown to have a high interferon inducing capacity. Induction was optimal when the virus was applied to the mucous membranes of the oral cavity. Clinical trials showed significant effects of interferon induction in recurrent herpetic infections. Oral application of vaccines needs neither trained staff nor medical equipment. It confers short term non-specific protection from disease, followed by specific immunity. The usual contraindications to smallpox vaccination need not be observed. Untoward effects, quite common to routine methods, are not to be expected. Author

**N76-14770** Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France).

**INCIDENCE OF INFECTIOUS TROPICAL DISEASES DIAGNOSED ON FLYING PERSONNEL [IMPORTANCE DE LA PATHOLOGIE INFECTIEUSE D'ORIGINE TROPICALE DANS L'EXPERTISE MEDICALE DU PERSONNEL NAVIGANT]**

R. Carre, J. Patacq-Crouzet, A. Didier, and J. Bastien *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 6 p In FRENCH (For availability see N76-14758 05-52)

Statistical data on the incidence of infectious tropical diseases diagnosed during the period 1969 to 1972 on French military and commercial flight crews was presented. The personnel examined were those making regular trips to Africa, Madagascar, the West Indies, and Reunion Island. The two diseases most widely detected were amebiosis (106 cases, including 13 severe cases localized in the liver and 93 cases localized in the intestinal tract) and malaria (45 cases, including 8 severe cases with encephalic and comatose involvements). The following other parasitic diseases were observed: bilharziasis (5 cases), filariasis (4 cases), stomatosis (2 cases), strongyloidiasis (8 cases), and ankylostomiasis (5 cases). Most cutaneous diseases detected were of bacterial origin. Viral hepatitis was widely observed on personnel having travelled in Africa, and dengue was diagnosed on military personnel returning from the Pacific. Y.J.A.

**N76-14771** Tropen Inst., Hamburg (West Germany).

**DIAGNOSTIC METHODS IN TROPICAL MEDICINE**

Werner Mohr *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 3 p (For availability see N76-14758 05-52)

The doctor consulted by persons returning from overseas countries should have a certain knowledge of geographical medicine. He must know in which regions on the globe malaria occurs, and where intestinal diseases are prevalent. A precise anamnesis of the patient's itinerary is most essential. During the physical examination the examiner is likely to recognize a number of symptoms which will help him along diagnostically: (1) Rashes and dischromia; (2) edemas; (3) fever; (4) enlargement of the liver; (5) enlargement of the spleen; (6) respiratory changes; (7) changes in stool (diarrhea); and (8) changes in urine (hematuria), to name but a few. Author

**N76-14772** Bayerische Landesimpfanstalt, Munich (West Germany).

**THE THREAT OF TROPICAL DISEASES AND PARASITOSES (SOME EPIDEMIOLOGICAL AND CLINICAL ASPECTS)**

G. T. Werner, H. Chr. Huber, H. Stickl, and V. Hochstein-Mintzel *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 5 p refs (For availability see N76-14758 05-52)

The rapid increase of travels to the warm countries has brought the threat of tropical diseases to our doors. Furthermore a great number of people are in employment overseas. Besides, the continuous influx of laborers, students or immigrants from tropical countries can create new medical problems. There is no real danger that tropical diseases are going to cause epidemics in the highly developed countries, as the hygienic standards prevent generalized outbreaks. There is, however, a substantial danger in the individual case due to missed or delayed diagnosis and treatment. Reviewed are those tropical diseases which are imported frequently or which present problems in the single case. Cosmopolitan diseases which are more common in the tropics, like hepatitis, polio, tuberculosis, are excluded. Author

**N76-14773** Tropen Inst., Hamburg (West Germany).

**AIR TRAFFIC AND THE PROBLEM OF IMPORTATION OF DISEASES FROM THE TROPICS**

Werner Mohr *In* AGARD Aeromedical Implications of Recent Experience with Communicable Disease Sep. 1975 3 p (For availability see N76-14758 05-52)

It is not possible to deal with all diseases which could be imported from the tropics to Europe or the temperate climate zones respectively. However, helminthic diseases should be referred to briefly. The most frequent and important ones among them are hookworm infestation, bilharziosis (schistosomiasis) in all its various forms, and filariasis. Time and again it can be observed that persons returning from the tropics may have contracted a variety of infectious diseases, especially intestinal parasites. There are a number of measures that should be taken to give protection against the diseases described above: (1) Protective inoculation against certain diseases and prophylactic medication; (2) it is of great importance to instruct physicians at home, i.e. in the temperate climate zones, in tropical diseases and their diagnosis; and (3) any person on return from the tropics should be subject to a close medical examination, in particular when such a person suffered from any disturbances of health during his stay in the tropics or is still suffering from such disturbances. Author

**N76-14774*#** Southwest Research Inst., San Antonio, Tex.

**SHORT RANGE MINIATURIZED BIOTELEMETRY SYSTEM Final Report**

R. Lorenz 11 Dec. 1975 18 p

(Contract NAS9-14404; SwRI Proj. 16-4118)

(NASA-CR-144640) Avail: NTIS HC $3.50 CSCL 06B

A biotelemetry system for measuring and transmitting EKG, EMG, and EEG data by an RF link to a receiver was designed, developed, and delivered. The system is battery operated with the batteries and transmitting electronics an integral part of the electrode sensors. The low frequency response of 0.05 Hz assures faithful reproduction of detailed EKG and all measurements are made by the utilization of two electrode sensors. Author

**N76-14775#** Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).

**NEUROMUSCULAR BLOCKING PROPERTIES OF LINCOMYCIN AND KANENDOMYCIN IN MAN**

Y. Hashimoto, N. Iwatsuki, T. Shima, and K. Iwatsuki [1975] 13 p refs Transl. into ENGLISH from Masui (Japan), v. 20, no. 5, 1971 p 407-411

(NRC/CNR-TT-1833) Avail: NTIS HC $3.50

It has been well recognized that certain antibiotics such as neomycin and streptomycin have a neuromuscular blocking action, occasionally resulting in postoperative prolonged respiratory depression. An interaction between muscle relaxants and lincomycin as well as 2prime-amion-2prime-deoxy kanamycin (Kanendomycin) was investigated in man anesthetized with nitrous oxide, oxygen and halothane. Twitch tension of the finger following an electric nerve stimulation was recorded to evaluate the degree of neuromuscular block. Kanendomycin by itself

produced a marked reduction in twitch tension when it was given intravenously in a dose of 2gm. The neuromuscular blocking action of d-tubocurarine chloride was potentiated by both these antibiotics and these effects were antagonized by edrophonium and calcium chloride. The action of succinylcholine was not affected by lincomycin, but it was potentiated transistorily by Kanendomycin. The results suggest that it is advisable to pay attention to possible respiratory depression when these antibiotics are used parenterally in combination with nondepolarizing muscle relaxants and in myasthenic patients. Author

**N76-14776#** Militaerpsykologiska Institutet, Stockholm (Sweden).
**RECONNAISSANCE AND VISUAL CONTRAST [SPANING OCH VISUELL KONTRAST]**
Sten Sture Bergstroem (Uppsala Univ.) and Ove Franzen (Uppsala Univ.) Apr. 1974 36 p refs In SWEDISH
(MPI-23) Avail: NTIS HC $4.00

Man is studied as an observer and detector of light signals. The report largely consists of a systematic review of known facts concerning conditions which influence man's contrast threshold. It can apply to qualities of the signal and its background such as luminance dispersal, duration, color, form and movement. The results are discussed for some cases which come within the reference framework either of preception psychology or neurophysiology. A literature search reveals gaps in our knowledge of contrast thresholds, particularly for moving signals and heterogeneous backgrounds. Author

**N76-14777#** Civil Aeromedical Inst., Oklahoma City, Okla.
**THE USE OF VESTIBULAR TESTS IN CIVIL AVIATION MEDICAL EXAMINATIONS: SURVEY OF PRACTICES AND PROPOSALS BY AVIATION MEDICAL EXAMINERS**
William E. Collins, Amelia O. Lennon, and E. Jean Grimm Apr. 1975 7 p refs
(AD-A015087/0; FAA-AM-75-4) Avail: NTIS HC $3.25 CSCL 06/14

A brief, voluntary questionnaire was administered to 1,115 Aviation Medical Examiners (AME) to assess the frequency with which vestibular tests (broadly defined) were given during physical examinations of pilots, which tests were used, why they were used, whether AMEs believed that specific tests should be routine, and why they believed so. Of the respondents, 58 percent routinely gave tests of balance, equilibrium, or vestibular functioning, 24 percent gave the tests under certain conditions, and 18 percent gave no tests. The Romberg and finger-pointing tests were the most frequently used and were employed most often for screening purposes or to identify a problem area. It is concluded that: (1) any introduction of specific tests of vestibular function or equilibrium should be based in the overall medical value of the tests (not in an effort to significantly reduce disorientation-related general aviation fatalities by seeking to identify the disorientation prone, since most such accidents appear to be related to normal functioning of the vestibular system), and (2) the tests should be simple. Author

**N76-14778#** Federal Aviation Administration, Washington, D.C. Aeromedical Applications Div.
**TO SEE OR NOT TO SEE: VISUAL ACUITY OF PILOTS INVOLVED IN MIDAIR COLLISIONS**
Leonard C. Ryan, S. J. Gerathewohl, Stanley R. Mohler, and Charles F. Booze, Jr. (Civil Aeromed. Inst.) Sep. 1975 6 p
(AD-A016277/6; FAA-AM-75-5) Avail: NTIS HC $3.25 CSCL 01/2

The medical records of airmen involved in midair collisions from 1970 through 1973 were reviewed and compared with two other groups of pilots: (1) pilots involved in other types of accidents; and (2) pilots without any accident records. There is nothing in the results to indicate that the pilots with visual corrections are a greater risk. Author

**N76-14779#** Louisville Univ., Ky. School of Medicine.
**CORRELATION OF ANIMAL, CRYPT, AND STEM CELL SURVIVAL IN FISSION NEUTRON IRRADIATED MICE: A CHEMICAL PROTECTION STUDY Final Report, Oct. 1971 - Dec. 1974**
Curtis P. Sigdestad 1 Feb. 1975 102 p refs
(Contract DADA17-72-C-2038)
(AD-A014065) Avail: NTIS CSCL 06/15

The report surveys the effectiveness of newly synthesized antiradiation compounds (WR-2721, WR-77913, WR-638, WR-1607, WR-2347, WR-3689, WR-109342, WR-2822, and WR-2823) in comparison with the other protectors (MEA and AET). The effects of high energy X-rays (4 MeV) and fission neutrons was tested on (1) intestinal crypt survival, (2) lethality, LD50 and (3) total and per crypt cellularity. GRA

**N76-14780#** School of Aerospace Medicine, Brooks AFB, Tex.
**ALCOHOL AND AVIATION Aeromedical Review**
John A. Bishop Jul. 1975 29 p refs
(AD-A013726; SAM-Review-3-75; SAM-TR-75-17) Avail: NTIS CSCL 06/15

The review provides Air Force flight surgeons information regarding the more common problems of alcohol and aviation. Background, problems, chemistry, and pharmacology of alcohol are discussed. This represents one aspect of continuing education in aerospace medicine for the flight surgeon. GRA

**N76-14781#** Federation of American Societies for Experimental Biology, Bethesda, Md.
**SENSITIVITY OF AUDITORY AND VESTIBULAR SYSTEMS TO STIMULI OTHER THAN SOUND AND MOTION Technical Interim Report**
Kenneth D. Fisher, C. Jelleff Carr, and John M. Talbot Apr. 1975 23 p refs
(Contract F44620-74-C-0077; ARPA Order 2808)
(AD-A013617; AFOSR-75-1125TR) Avail: NTIS CSCL 05/10

There is evidence to suggest that auditory and vestibular systems can be stimulated by forms of energy other than sound, gravity and motion. This report reviews the evidence related to such sensitivity and indicates the potential importance of enhanced sensory capabilities. Suggestions for future research on the response of the auditory and vestibular systems to additional environmental stimuli are presented. GRA

**N76-14782#** Federation of American Societies for Experimental Biology, Bethesda, Md. Life Sciences Research Office.
**THE RHYTHMIC CYCLES IN MAN**
Herbert Pollack Apr. 1975 28 p refs
(Contract F44620-74-C-0077; ARPA Order 2808; AF Proj. 6813)
(AD-A013853; AFOSR-75-1126TR) Avail: NTIS CSCL 06/16

There is ample evidence to accept the concept of multiplicity of cyclic and rhythmic functions in plants, animals and man. These vary from the ultradian and circadian to seasonal and annual cycles. There are numerous factors involved in these cyclic phenomena, from photostimulation (day-night cycle) to exhaustion-replenishment feedback mechanisms. Man's ability to override the rhythms is an important factor which allows him to undertake many activities and not be limited by the rhythmic nature of these underlying mechanisms. The override capability enables him to maintain his work performance efficiently providing he is motivated and interested. Thus motivation may be more important than the circadian rhythm which can be disrupted but restored easily with the proper stimulation. The report reviews research in this field and notes areas for future research and names key investigators. GRA

**N76-14783#** Hawaii Univ., Honolulu. Dept. of Physiology.
**WORK CAPACITY AND CARDIOVASCULAR ADJUSTMENTS OF NON-DIVING MAMMALS IN HYPERBARIC ENVIRONMENT Final Report, 1 Feb. 1972 - 31 Jul. 1975**
Y. C. Lin, L. H. Chen, and D. G. Baker 31 Jul. 1975 108 p refs
(Contract N00014-67-A-0387-0014; NR Proj. 201-136)
(AD-A014007) Avail: NTIS CSCL 06/19

Some factors which limit human performance in the hyperbaric environments have been studied in the past, employing a controlled environment consisting of lumped parameters of pressure, gas density, levels of partial pressure of oxygen, carbon dioxide, and inert gases, ambient temperature, and humidity. The present study was designed to examine the possible interaction among these variables on the work capacity of rats, at rest and during exercise. The rat, like man, is a terrestrial non-diving mammal, and is the model employed in this study. Swimming was utilized in the present study as a means of imposing a work load on

the rat. Measurements of cardiac output and its distribution, autonomic nervous control of cardiovascular functions, and oxygen consumption and conservation during apnea were studied in detail. The authors have studied the specific helium effects in the intact animal and in the isolated-perfused heart. GRA

**N76-14784#** Kentucky Univ., Lexington. Wenner-Gren Research Lab.
**STUDY OF HEART SYNCHRONOUS WHOLE BODY ACCELERATION FOR CIRCULATORY ASSIST Report for 15 May 1973 - 12 Nov. 1974**
C. F. Knapp, E. P. McCutcheon, A. Bhattacharya, and J. M. Evans Nov. 1974 123 p refs
(Contract HT-3-2928)
(PB-243807/5) Avail: NTIS HC $5.50 CSCL 06E

Cardiovascular responses of awake, chronically instrumented canines exposed to whole body acceleration (vibration) were investigated. Both normal and myocardially ischemic subjects were studied. Conclusions were that: (1) cardiovascular responses could be dialed in and maintained by proper synchronization; (2) force waveforms applied to the ischemic preparation produced greater cardiovascular effects, and (3) greater modification to cardiac function was produced by a heart synchronous asymmetrical, headward displacement waveform, increasing aortic diastolic pressure by 42% and cardiac work by 66%. GRA

## 53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**N76-14785** Texas Technological Univ., Lubbock.
**HUMAN PERFORMANCE PHYSIOLOGICAL RHYTHMS, AND CIRCADIAN TIME RELATIONS Ph.D. Thesis**
Nancy Jo Jensen Bethea 1975 199 p
Avail: Univ. Microfilms Order No. 75-26834

During performance testing, three groups of subjects recorded their oral temperature and resting heart rate at intervals throughout the day. At the same time they worked multiplication or addition problems to simulate mental performance. All subjects collected urine voided during the testing weeks. The volumes were measured and specimens analyzed for sodium, potassium, chloride, urea nitrogen, uric acid, creatinine, and inorganic phosphate. Testing of psychomotor performance and rhythmometric analyses found some consistent phase relationships between physiological variables, performance levels, and individual rhythms. Some indication of circadian variability were observed. Dissert. Abstr.

**N76-14786#** Militaerpsykologiska Institutet, Stockholm (Sweden).
**AUDITORY PERCEPTION, A LITERATURE REVIEW**
Hans Furustig Mar. 1974 67 p refs In SWEDISH; ENGLISH summary
(MPI-A-22) Avail: NTIS HC $4.50

Fundamental variables in the auditory perception relevant for audible alarms are described. Dependences between the perceptual process and the characteristics of the alarm signal are discussed. The perception depends on the signal expectation, the complexity of the discrimination situation and the arousal of the individual. For air-raid signals there are also factors of the population which influence the perceptual readiness such as age, health status and family size. A holistic approach to the perception of audible alarm signals like the Gestalt Psychology is also discussed. The auditory awakening frequencies as a function of stimulus intensity at a given background noise level are estimated. Author

**N76-14787*#** Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
**UNIVERSITY OF VIRGINIA ACQUISITION OF PASSENGER RIDE QUALITY DATA ABOARD THE TOTAL IN-FLIGHT SIMULATOR (TIFS)**
Eugene W. McClurken, Jr. Oct. 1975 112 p ref
(Grant NGR-47-005-181)
(NASA-CR-145957; TR-403220) Avail: NTIS HC $5.50 CSCL 05E

The subjective response of passengers to vehicle motions was investigated on the Total In-Flight Simulator (TIFS) aircraft. Prerecorded signals were converted into controlled aircraft motion for evaluation by ten subjects on a seven-point rating scale. Eighteen test flights were flown on August and September 1974, the results of which are to be used in validation studies on ground based simulators at NASA/Langley Research Center and to extend passenger response models. Author

**N76-14788*#** Old Dominion Univ. Research Foundation, Norfolk, Va.
**A REVIEW AND PRELIMINARY EVALUATION OF METHODOLOGICAL FACTORS IN PERFORMANCE ASSESSMENTS OF TIME-VARYING AIRCRAFT NOISE EFFECTS Final Report**
Glynn D. Coates and Earl A. Alluisi Oct. 1975 43 p refs
(Grant NsG-1092)
(NASA-CR-145925; PAL-PR-75-4) Avail: NTIS HC $4.00 CSCL 05E

The effects of aircraft noise on human performance is considered. Progress is reported in the following areas: (1) review of the literature to identify the methodological and stimulus parameters involved in the study of noise effects on human performance; (2) development of a theoretical framework to provide working hypotheses as to the effects of noise on complex human performance; and (3) data collection on the first of several experimental investigations designed to provide tests of the hypotheses. Author

**N76-14789*#** Scientific Translation Service, Santa Barbara, Calif.
**THE PHYSIOLOGICAL BASIS OF INDUSTRIAL WORK**
Joseph Rutenfranz Washington NASA Dec. 1975 27 p refs Transl. into ENGLISH from Zentr. Bakteriol. Parasitenk., Abt. Reihe B. Orig. (Berlin), v. 158, 1973 p 219-238
(Contract NASw-2791)
(NASA-TT-F-16808) Avail: NTIS HC $4.00 CSCL 05E

The following topics of modern industrial work are discussed: (1) relationship between physical fitness and the endurance limit at heavy work; (2) problems of rest pauses, and their physiological and psychological implications; and (3) basic problems of circadian rhythms in relation to night and shift work. Author

**N76-14790*#** Massachusetts Inst. of Tech., Cambridge. Man-Vehicle Lab.
**INTEGRATION OF VISUAL AND MOTION CUES FOR SIMULATOR REQUIREMENTS AND RIDE QUALITY INVESTIGATION Semiannual Status Report, May - Nov. 1975**
L. R. Young Nov. 1975 40 p refs
(Grant NsG-22-009-701)
(NASA-CR-145978) Avail: NTIS HC $4.00 CSCL 05E

Preliminary tests and evaluation are presented of pilot performance during landing (flight paths) using computer generated images (video tapes). Psychophysiological factors affecting pilot visual perception were measured. A turning flight maneuver (pitch and roll) was specifically studied using a training device, and the scaling laws involved were determined. Also presented are medical studies (abstracts) on human response to gravity variations without visual cues, acceleration stimuli effects on the semicircular canals, and neurons affecting eye movements, and vestibular tests. J.R.T.

**N76-14791*#** Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
**PASSENGER COMFORT RESPONSE TIMES AS A FUNCTION OF AIRCRAFT MOTION**
Edward J. Rinalducci Oct. 1975 34 p refs
(Contract NGR-47-005-202)
(NASA-CR-145981; TR-403906; ESS-4039-104-75) Avail: NTIS HC $4.00 CSCL 05E

The relationship between a passenger's response time of changes in level of comfort experienced as a function of aircraft motion was examined. The aircraft used in this investigation was capable of providing a wide range of vertical and transverse accelerations by means of direct lift flap control surfaces and side force generator surfaces in addition to normal control surfaces. Response times to changes in comfort were recorded

along with the passenger's rating of comfort on a five point scale. In addition, a number of aircraft motion variables including vertical and transverse accelerations were also recorded. Results indicate some relationship between human comfort response times to reaction time data. Author

**N76-14792*#** Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.

**FLIGHT RESEARCH EXPERIMENTS ON RIDE QUALITY**

I. D. Jacobson and A. R. Kuhlthau Oct. 1975 28 p refs

(Grant NGR-47-005-202)

(NASA-CR-145984; TR-403907; ESS-4039-105-75) Avail: NTIS HC $4.00 CSCL 05E

The results and analysis of several flight research experiments in ride quality are described. These tests were carried out aboard the NASA Flight Research Center, JetStar Aircraft equipped with the General Purpose Airborne Simulator; and aboard a specially instrumented Boeing 747 flown in actual commercial flight. The data was analyzed to determine appropriate models for subjective reaction to the motion environment. Specifically, vertical and transverse acceleration inputs and aircraft bank angle were studied along with duration of exposure. Author

**N76-14793*#** North Carolina State Univ., Raleigh.

**INDIVIDUAL DIFFERENCES IN HUMAN ANNOYANCE RESPONSE TO NOISE**

Richard G. Pearson, Franklin D. Hart, and John F. OBrien [1975] 64 p refs

(Grant NGR-34-002-055)

(NASA-CR-144921) Avail: NTIS HC $4.50 CSCL 05E

Individual variations in annoyance and in susceptibility to noise were studied to establish a finer definition of the ingredients of the human annoyance response. The study involved interactions among a heterogeneous sample of human subjects, various noise stimuli, and different physical environments of exposure. Significant differences in annoyance ratings among the six noise stimuli, all equated for peak sound pressure level, were found. Author

**N76-14794#** Michigan Univ., Ann Arbor. Inst. for Social Research.

**GROUP TYPES AND INTERVENTIONS EFFECTS IN ORGANIZATIONAL DEVELOPMENT**

David G. Bowers and Doris L. Hausser Nov. 1974 155 p refs

(Contract N00014-67-A-0181-0048)

(AD-A004638) Avail: NTIS CSCL 05/9

The present report explores the organizational development uses of survey data. In form, the problem is one of testing the feasibility of developing an instrumented prescriptive capability for organizational development activities in the Navy. The strategy involved: (1) determining whether there are relatively few pure types of groups present in the civilian data bank which accompanies the Survey of Organizations questionnaire - the parent instrument of the Navy's Human Resource Management Survey (2) determining from the Navy data collected in the course of this present contract the extent to which these pure types exist in the Navy as well; and (3) examining the effect of different development activities upon the pure types thus identified. GRA

**N76-14795#** Army Foreign Science and Technology Center, Charlottesville, Va.

**SEPARATION OF USEFUL SIGNAL FROM NOISE IN THE NEURONAL IMPULSE ACTIVITY OF THE COCHLEAR NUCLEUS OF A CAT**

E. A. Radionova 30 Apr. 1975 19 p refs Transl. into ENGLISH from Zh. Vyssh. Nerv. Deyateln. im. I. P. Pavlova (USSR), v. 15, no. 3, 1965 p 481-489

(AD-A014052; FSTC-HT-23-0706-75) Avail: NTIS CSCL 06/16

The detection and separation of useful signals from noise was studied with 180 neurons of the cochlear nucleus of a cat in sodium amytal narcosis. Characteristics of background activity of neurons of the cochlear nucleus were investigated as to the masking of useful signals by background and as to the distribution of neurons in terms of spontaneous activity. GRA

**N76-14796#** Minnesota Univ., Minneapolis. Dept. of Psychology.

**STRATEGIES OF ADAPTIVE ABILITY MEASUREMENT**

David J. Weiss Dec. 1974 83 p refs

(Contract N00014-67-A-0113-0029; NR Proj. 150-343)

(AD-A004270; RR-74-5) Avail: NTIS CSCL 05/9

A number of strategies are described for adapting ability test items to individual differences in ability levels of testees. Each strategy consists of a different set of rules for selecting the sequence of test items to be administered to a given testee. Advantages and disadvantages of each strategy are discussed, and research issues unique to the strategy are described. Strategies reviewed are differentiated into two-stage approaches and multistage approaches. Several variations of the two-stage approach are described. Multistage strategies include fixed branching and variable branching strategies. Fixed branching strategies reviewed include a number of variations of the pyramidal approach (e.g., constant step size pyramids, decreasing step size pyramids, truncated pyramids, multiple-item pyramids), the flexilevel test, and the stradaptive test. Variable branching approaches include two Bayesian strategies and two maximum likelihood strategies. The various strategies are compared with each other on important characteristics and on practical considerations, and ranked on their apparent potential for providing measurement of equal precision at all levels of ability. Author

**N76-14797#** Federation of American Societies for Experimental Biology, Bethesda, Md.

**BIOLOGICAL CORRELATES OF COGNITIVE, SENSORY AND MOTOR ABILITIES**

John M. Talbot Apr. 1975 34 p refs

(Contract F44620-74-C-0077; ARPA Order 2808)

(AD-A013616; AFOSR-75-1124TR) Avail: NTIS CSCL 05/10

The review of somaesthesis attempts to highlight its biological correlates and to relate somatic sensory processes to behavior. Current knowledge of the somaesthetic systems is summarized and significant gaps are noted. Exciting disclosures in the anatomy, physiology, biochemistry and biophysics of somaesthetic systems are surfacing with increasing frequency as a result of modern research approaches. Progress has been rapid in the electrophysiological 'mapping' of afferent systems from the peripheral receptors into the sensorimotor cortex and in identifying in other parts of the brain and brain stem, neurons and groups of cells which respond to somaesthetic stimulation. Sensory feedback and control are under investigation, and important revelations of perceptual processes, especially in vision and hearing, are being published. GRA

**N76-14798#** Federation of American Societies for Experimental Biology, Bethesda, Md. Life Sciences Research Office.

**NEURAL INTEGRATION IN LEARNING AND MEMORY: A HYPOTHESIS**

Sven A. Bach Apr. 1975 37 p refs

(Contract F44620-74-C-0077; ARPA Order 2808; AF Proj. 6813)

(AD-A013854; AFOSR-74-1123TR) Avail: NTIS

Presented is a hypothesis concerning neural integration in learning and memory based on biochemical events in this time domain. The hypothesis suggests that one of the events involved in intraneuronal message transfer may be pumping of lattice-vibrational states by signals pulsed to match the relaxation time of such states. The energy levels attainable can in turn match those required for conformational changes in macromolecules. Intracellular processes may play an equal or larger role in neural functioning than events measurable across the cell-membrane. The hypothesis provides a basis for study of early, time-variable concentrations of metabolic intermediates, metabolites and secretory products of neurons during memory and learning. GRA

**N76-14799#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

**A NEW TIME-DOMAIN ANALYSIS OF HUMAN SPEECH AND OTHER COMPLEX WAVEFORMS Ph.D. Thesis**

Janet MacIver Baker May 1975 159 p refs

(Contract F44620-73-C-0074; ARPA Order 2466)

(AD-A013583; AFOSR-75-1083TR) Avail: NTIS CSCL 05/7

The purpose of this research is to explore the usefulness of a new time-domain analysis of complex waveforms, especially

with respect to human speech. Essentially three separate investigations are presented, with the last two predicated on the results of the first: (1) Cycle-based time-domain parameters were extracted from the speech waveforms of many hundreds of utterances, and were then subjected to extensive scrutiny, both by hand and by machine. (2) Based solely on time-domain phenomena found in the previous study, the authors wrote an automatic segmentation program for continuous speech. (3) They examined the time-domain acoustic characteristics of 228 allophones of fricatives and stop consonants, for each of three speakers (2 males, 1 female). Finally, they present a personal view of the synergism inherent in the utilization of these time-domain techniques with the traditional frequency-domain techniques. In addition, suggestions are presented for applying these generalizable time-domain techniques to other complex waveforms, especially amenable to such analysis. Specific examples are drawn from music (e.g. violin) and animal (e.g. bou-bou shrike) vocalizations. GRA

**N76-14800#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
**A MODEL OF HUMAN COGNITIVE BEHAVIOR IN WRITING CODE FOR COMPUTER PROGRAMS, VOLUME 1**
Ruven Brooks May 1975 155 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A013582; AFOSR-75-1084TR) Avail: NTIS CSCL 05/10

A theory of human cognitive processes in writing code for computer programs is presented. It views behavior in terms of three processes, understanding, planning, and coding. The first of these consists of acquisition of information from the problem instructions and directions. This is used by the planning process to create a solution plan stated as a set of functional specifications in a language which is independent of the syntax of the particular programming language. The coding process converts this plan to code using a process named symbolic execution in which pieces of code are assigned effects expressed in terms of the functions the programmer intends the code to perform in achieving the purpose of the program. Within the framework of this theory, a more explicit model of the coding process was developed. The model is based on a production system and has been implemented as a computer program. Given plans taken from protocols of a programmer writing a series of short FORTRAN programs, it is able to generate the same code in the same order as the programmer did. GRA

**N76-14801#** Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
**THE LOW-LEVEL SYMBOLIC REPRESENTATION OF INTENSITY CHANGES IN AN IMAGE**
David Marr Dec. 1974 45 p refs
(Contract N00014-70-A-0362-0005)
(AD-A013669; AI-M-325) Avail: NTIS CSCL 06/4

A family of symbols is defined by which much of the useful information in an image may be represented, and its choice is justified. The family includes symbols for the various commonly occurring intensity profiles that are associated with the edges of objects, and symbols for the gradual luminance changes that provide clues about a surface's shape. It is shown that these descriptors may readily be computed from measurements similar to those made by simple cells in the visual cortex of the cat.
Author (GRA)

## 54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

**N76-14802** Georgia Inst. of Tech., Atlanta.
**THE MAN-MACHINE TASK ALLOCATION PROBLEM WITH SEQUENCING CONSIDERATIONS Ph.D. Thesis**
Robert Lee Bulfin, Jr. 1975 145 p
Avail: Univ. Microfilms Order No. 75-26202

Scheduling problems that involve a human as well as a machine component are discussed. Each component of the system must process certain operations of some project but, in addition, there are other operations that can be performed by either. It is assumed that all operation processing times are sequence independent but do depend on which component processes the operation. Precedence constraints, defined as conditional and absolute, are allowed. A branch-and-bound approach is developed to treat the problem where minimum total completion time is the measure of performance. Suitable computational experience is given. A variation of this problem, called the sequence dependent problem, is also investigated. Dissert. Abstr.

**N76-14803** Kent State Univ., Ohio.
**REAL EAR ATTENUATION OF PERSONAL EAR PROTECTIVE DEVICES WORN IN INDUSTRY Ph.D. Thesis**
Donald E. Regan 1975 163 p
Avail: Univ. Microfilms Order No. 75-27823

The principal purpose of this investigation was to determine if manufacturers' attenuation specifications realistically reflect the actual attenuation provided by protective devices when worn by industrial employees in the work place. The differences in attenuation, if any existed, between various makes and models of protective devices were also investigated. Results indicate that attenuation provided to the worker is significantly less than manufacturers' specifications. All ear protectors' attenuation was not only significantly less than manufacturers' data, but was also below the low-fence requirements suggested by SACON.
Dissert. Abstr.

**N76-14804*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
**AUTOMATIC BIOWASTE SAMPLING Patent**
G. L. Fogal (GE, Philadelphia) and Richard L. Sauer, inventors (to NASA) (GE, Philadelphia) Issued 28 Oct. 1975 8 p Filed 22 Nov. 1974 Supersedes N75-13536 (13 - 04, p 0458) Sponsored by NASA
(NASA-Case-MSC-14640-1; US-Patent-3,915,012; US-Patent-Appl-SN-526449; US-Patent-Class-73-421R; US-Patent-Class-128-2F) Avail: US Patent Office CSCL 06B

A solids biowaste sampling system for use under space flight conditions is described. The sampling system is comprised of: a storage container; a seat; and a tissue bypass which permits passage of a waste sample to a slinger assembly or delivery of tissue directly into the interior of the storage container. The slinger assembly has a rotating platform which radially distributes the biowaste materials transverse to the vertical in a shredded form. The biowaste material is collected by a sampling strip for retention and examination.
Official Gazette of the U.S. Patent Office

**N76-14805*#** Southwest Research Inst., Houston, Tex.
**STUDY OF VOLATILE CONTAMINANTS IN RECLAIMED WATER Final Report**
Herbert C. McKee, John D. Millar, and N. F. Swynnerton Oct. 1975 40 p refs
(Contract NAS9-12843)
(NASA-CR-144636; SwRI-01-3391-001) Avail: NTIS HC $4.00 CSCL 06K

Different methods were evaluated for reducing the volatile contaminants found in water recovered from urine by distillation. The use of activated carbon, addition of potassium permanganate, and the use of oxidation catalyst are described along with laboratory tests. It is concluded that catalytic decomposition appears to be feasible, and further investigation is recommended. F.O.S.

**N76-14806*#** Missouri Univ., Columbia.
**MULTIPLE NUTRIENT MARKERS. ENERGY AND NUTRIENT Final Report**
T. D. Luckey, B. Venugopal, and D. P. Hutcheson 1975 139 p refs
(Contract NAS9-12369)
(NASA-CR-144635) Avail: NTIS HC $6.00 CSCL 06K

A passive system to determine the in-flight intake of nutrients is developed. Nonabsorbed markers placed in all foods in proportion to the nutrients selected for study are analyzed by neutron activation analysis. Fecal analysis for each market indicates how much of the nutrients were eaten and apparent digestibility. Results of feasibility tests in rats, mice, and monkeys indicate

the diurnal variation of several markers, the transit time for markers in the alimentary tract, the recovery of several markers, and satisfactory use of selected markers to provide indirect measurement of apparent digestibility. Recommendations are provided for human feasibility studies. Author

**N76-14807*#** Quantum Dynamics, Tarzana, Calif. Advanced Experimental Research and Instrumentation.
**DEVELOPMENT OF A HIGH-RESOLUTION AUTOMATIC DIGITAL (URINE/ELECTROLYTES) FLOW VOLUME AND RATE MEASUREMENT SYSTEM OF MINIATURE SIZE Final Report**
Frederick F. Liu 20 Aug. 1975 43 p
(Contract NAS9-14433)
(NASA-CR-144646) Avail: NTIS HC $4.00 CSCL 06K

To aid in the quantitative analysis of man's physiological rhythms, a flowmeter to measure circadian patterns of electrolyte excretion during various environmental stresses was developed. One initial flowmeter was designed and fabricated, the sensor of which is the approximate size of a wristwatch. The detector section includes a special type of dielectric integrating type sensor which automatically controls, activates, and deactivates the flow sensor data output by determining the presence or absence of fluid flow in the system, including operation under zero-G conditions. The detector also provides qualitative data on the composition of the fluid. A compact electronic system was developed to indicate flow rate as well as total volume per release or the cumulative volume of several releases in digital/analog forms suitable for readout or telemetry. A suitable data readout instrument is also provided. Calibration and statistical analyses of the performance functions required of the flowmeter were also conducted. Author

**N76-14808*#** Life Systems, Inc., Cleveland, Ohio.
**ZINC DEPOLARIZED ELECTROCHEMICAL CO2 CONCENTRATION Final Report, Feb. - Oct. 1975**
R. R. Woods, R. D. Marshall, and F. H. Schubert Oct. 1975 60 p refs
(Contract NAS2-6478)
(NASA-CR-137731; ER-267-3) Avail: NTIS HC $4.50 CSCL 06K

Two zinc depolarized electrochemical carbon dioxide concentrator concepts were analytically and experimentally evaluated for portable life support system carbon dioxide (CO2) removal application. The first concept, referred to as the zinc hydrogen generator electrochemical depolarized CO2 concentrator, uses a ZHG to generate hydrogen for direct use in an EDC. The second concept, referred to as the zinc/electrochemical depolarized concentrator, uses a standard EDC cell construction modified for use with the Zn anode. The Zn anode is consumed and subsequently regenerated, thereby eliminating the need to supply H2 to the EDC for the CO2 removal process. The evaluation was based primarily on an analytical evaluation of the two ZnDCs at projected end item performance and hardware design levels. Both ZnDC concepts for PLSS CO2 removal application were found to be noncompetitive in both total equivalent launch weight and individual extravehicular activity mission volume when compared to other candidate regenerable PLSS CO2 scrubbers. Author

**N76-14809*#** Life Systems, Inc., Cleveland, Ohio.
**ELECTROCHEMICAL CARBON DIOXIDE CONCENTRATOR ADVANCED TECHNOLOGY TASKS Final Report, 1 Jul. 1973 - 25 Aug. 1975**
J. J. Schneider, F. H. Schubert, T. M. Hallick, and R. R. Woods Oct. 1975 137 p refs
(Contract NAS2-6478)
(NASA-CR-137732; ER-170E-4) Avail: NTIS HC $6.00 CSCL 06K

Technology advancement studies are reported on the basic electrochemical CO2 removal process to provide a basis for the design of the next generation cell, module and subsystem hardware. An Advanced Electrochemical Depolarized Concentrator Module (AEDCM) is developed that has the characteristics of low weight, low volume, high CO2, removal, good electrical performance and low process air pressure drop. Component weight and noise reduction for the hardware of a six man capacity CO2 collection subsystem was developed for the air revitalization group of the Space Station Prototype (SSP). Author

**N76-14810#** Hughes Aircraft Co., Culver City, Calif. Display Systems and Human Factors Dept.
**BINOCULAR RIVALRY IN HELMET-MOUNTED DISPLAY APPLICATIONS Final Technical Report, Apr. 1973 - Aug. 1974**
M. L. Hershberger and D. F. Guerin Jun. 1975 146 p refs
(Contract F33615-73-C-4145; AF Proj. 7184)
(AD-A013838; HAC-P74-417R; HAC-Ref-C7622; AMRL-TR-75-48) Avail: NTIS CSCL 05/8

A research program was conducted to determine the relationships between helmet-mounted display (HMD) design parameters and binocular rivalry. A screening study which investigated 12 parameters was then conducted to determine which parameters affected binocular rivalry with HMDs. A parametric study was next conducted to establish functional relationships between HMD parameters and binocular rivalry for the parameters identified in the screening study to have a major impact on binocular rivalry. The final laboratory study was a validation study which compared selected HMD system configurations in realistic HMD and non-HMD tasks for binocular rivalry effects. The image quality analysis evaluated the effects of ambient illumination, display luminance, combiner transparency, and angular display subtense on HMD video image quality using modulation transfer function analysis techniques. GRA

**N76-14811#** California Univ., Los Angeles. School of Engineering and Applied Science.
**BIOCYBERNETIC CONTROL IN MAN-MACHINE INTERACTION Semiannual Technical Report, 1 Jul. 1974 - 31 Jan. 1975**
Jacques J. Vidal and Marshall D. Buck Mar. 1975 60 p refs
(Contract N00014-69-A-0200-4055; ARPA Order 2816)
(AD-A013649; UCLA-ENG-7535) Avail: NTIS CSCL 06/4

The research program aims at incorporating EEG 'evoked responses' in man-machine communication. A methodology for the real-time discrimination of evoked responses by a computer in real-time has been developed. Extremely high rates of sensory stimulus identification from EEG have been achieved. The experimental paradigm has been completely implemented on the laboratory computer system. Experiments are now in progress that involve the EEG discrimination algorithm in an actual man-machine communication procedure. GRA

**N76-14812#** IBM Federal Systems Div., Gaithersburg, Md.
**PROGRAM DOCUMENTATION FOR THE PHASE 6 EWO CREW STATION SIMULATION PROGRAMS**
W. E. Brandt, Jr. and D. L. Wartluft Jan. 1975 57 p refs
(Contract F33615-72-C-1378)
(AD-A013848; AMRL-TR-75-22) Avail: NTIS CSCL 05/9

The Phase 6 EWO Crew Station Simulation Programs were written to provide a means for studying the performance of a trained electronic warfare officer during an electronic warfare simulation, and to analyze the impact of new equipment and the organization of old equipment on crew performance. A real-time program controls and monitors an electronic warfare simulator modified to include a set of equipment changes associated with the project. The times at which all input and output transitions occur are recorded for subsequent analysis. GRA

**N76-14020** Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
**AIRCREW CAPABILITIES AND LIMITATIONS**
R. N. Slarve *In* AGARD The Effects of Buffeting and other Transonic Phenomena on Maneuvering Combat Aircraft Jul. 1975 p 9-14 (For availability see N76-14018 05-01)

**N76-14038** Advisory Group for Aerospace Research and Development, Paris (France).
**SIMULATION DEVELOPMENT, VALIDATION AND PILOT LEARNING**
*In its* Approach and Landing Simulation Oct. 1975 p 19-28 (For availability see N76-14032 05-01)

# 55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

# 59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

# 60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

**N76-14813** British Library Lending Div., Boston Spa (England).
**PORTABLE COMPUTER EQUIPMENT FOR AUTOMATED ACCEPTANCE TESTING OF STEAM TURBINES**
G. Boguschewski [1974] 14 p refs Transl. into ENGLISH from BBC-Nachr. (Mannheim), v. 56, no. 4, 1974 p 128-133 (BLL-CE-Trans-6725-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

An automatic telemetry system for logging the data of acceptance tests for turbogenerators operating on radioactive steam is described which uses the DP 1000 process computer. The components, measurements, and measurement accuracy are discussed, and the measurement results evaluated. F.O.S.

**N76-14814** Virginia Univ., Charlottesville.
**THE SOLUTION OF LINEAR SYSTEMS OF EQUATIONS ON A VECTOR COMPUTER Ph.D. Thesis**
Jules Joseph Lambiotte, Jr. 1975 240 p
Avail: Univ. Microfilms Order No. 75-22800

The effect was investigated of vector computer architecture on the relative efficiency of algorithms to solve linear systems of equations. The study includes the analysis of standard methods, previously proposed parallel algorithms, and techniques. Timing formulas are derived for the algorithms discussed, and quantitative comparisons are made by using expected vector timing for the Control Data Corporation STAR-100. Direct methods are analyzed for both dense and sparse matrices with varying zero-nonzero structure. Factorization and substitution procedures are considered for a dense system when the matrix coefficients are stored either by rows or by columns. Storage schemes and solution procedures are proposed for solving a banded system of equations when there are either few or many right hand sides to the equation. It is shown that the right hand sides can be appended to the coefficient matrix to allow the forward solution to take place using the same vector operations which achieve the factorization. The profile storage and factorization method is analyzed, and some results are given for it in terms of a model finite element problem. Iterative techniques were investigated for solving the large, sparse matrix equations arising from finite difference discretizations. Dissert. Abstr.

**N76-14815** Columbia Univ., New York.
**COMPARABILITY GRAPHS AND A NEW MATROID Ph.D. Thesis**
Martin Charles Golumbic 1975 51 p
Avail: Univ. Microfilms Order No. 75-27418

An undirected graph (V,E) is a comparability graph if one can assign an orientation to the edges which is transitive as a binary relation on the vertices. In each iteration of the TRO algorithm a free choice of an edge is made. No matter how these edges are chosen, the number of iterations will always be the same for a given undirected graph, thus producing an invariant g(E) of the graph. An algebraic abstraction of the TRO algorithm, called a G-decomposition scheme, enables us to explain the cause of this invariant. A matroid structure associated with an undirected graph (not just comparability graphs), and g(E) equals the rank of the matroid, was found. A characterization of this matroid is given. All transitive orientations of a comparability graph were found. A construction procedure is given, and the number of transitive orientations is a product of factorials. Dissert. Abstr.

**N76-14816** Columbia Univ., New York.
**THE ANALOG COMPUTER AS AN INSTRUCTIONAL TOOL FOR ELEMENTARY DIFFERENTIAL EQUATIONS Ph.D. Thesis**
Roy Hugh McLeod 1975 174 p
Avail: Univ. Microfilms Order No. 75-27064

The design, development and informal trial of a course is presented in elementary differential equations in which the analog computer was used as a pedagogical tool. A classroom is described which included twenty-three hours of laboratory activity with the analog computer. An open-ended personal interview with each student was conducted at the conclusion of the trial to obtain student views and opinions related to several aspects of the experimental materials. The results of the informal trial indicate that the analog computer when used within a differential equations course as suggested in the experimental materials and manual of this study appears to aid the student in (1) relating abstract mathematical concepts to physical concepts, (2) comprehending the traditional subject matter, (3) developing positive attitudes towards man-machine interactions, (4) selecting the most appropriate solution to a problem, and (5) motivating learning and furthering interest in mathematics. Dissert. Abstr.

**N76-14817** Michigan State Univ., East Lansing.
**MATHEMATICAL FOUNDATIONS FOR RELATIONAL DATA BASES Ph.D. Thesis**
Raymond Youssef Fadous 1975 96 p
Avail: Univ. Microfilms Order No. 75-27259

The problem of constructing algorithms for finding keys for relational data bases and for determining whether a relation is in second or third normal form was considered. An algorithm which starts with the functional relations and finds all keys of a normalized relation is presented. The mathematical properties of a relation in second and third normal forms are studied in detail along with the properties of prime and non-prime attributes and algorithms are given for determining whether a relation is in either second or third normal form. Finally, data point to a weakness in the definitions of a relation in third normal form, as proposed by Codd and Kent, and advances the concept of a canonical normal form to overcome the disclosed weakness. Dissert. Abstr.

**N76-14818*** National Aeronautics and Space Administration. Pasadena Office, Calif.
**MULTI-COMPUTER MULTIPLE DATA PATH HARDWARE EXCHANGE SYSTEM Patent**
Tage O. Anderson, inventor (to NASA) (JPL) Issued 28 Oct. 1975 18 p Filed 6 Nov. 1974 Supersedes N75-12652 (13 - 03, p 0344) Sponsored by NASA
(NASA-Case-NPO-13422-1; US-Patent-3,916,380; US-Patent-Appl-SN-521601; US-Patent-Class-340-147R; US-Patent-Class-340-147C) Avail: US Patent Office CSCL 09B

A switch controller in a multi-computer processing system functions to establish a data path between any two computers in the system and maintain that data path, without interference, while establishing other independent unidirectional data paths with other pairs of computers. All computers in the system are continuously and rapidly scanned for a request-to-send signal. Those computers that are already engaged in data transmission are leap-frogged by the scanning mechanism. When a request-to-send signal is detected by a particular scanning mechanism, that scanning mechanism stops at the computer generating the

request, to provide for an interconnection between the requesting sender and the intended receiver. If during this interconnection phase, it is determined that the intended receiver is occupied, the interconnection is prevented from being completed and the scanning mechanism is instructed to resume scanning of the computers for another request-to-send signal.
Official Gazette of the U.S. Patent Office

**N76-14819#** Joint Publications Research Service, Arlington, Va.
**TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 489**
10 Dec. 1975 29 p refs Transl. into ENGLISH from Hungarian journals
(JPRS-66329) Avail: NTIS HC $4.00

Reports dealing with development and progress in Hungary in the following areas were presented: domestic computer technology applications, news of the academy central office, symposium on the interdisciplinary use of cyclotrons, roster of new candidates of sciences. A brief on electronics research spending was also included. The first report discussed applications of computer systems in the following areas: (1) economic planning and control, (2) state administration, central statistical services, census, and government registrations, (3) enterprise management and finances, (4) interactive systems, (5) aspects of the economic and technical planning of transportation and resource allocation, (6) computer assistance to technical designing, (7) industrial process control, (8) health services, (9) meteorological and hydrometeorological services, (10) scientific calculations and computer-aided experimentation, (11) education, information and public learning activities, (12) national contract work service, (13) numerical analysis, (14) mathematical statistics, (15) control theory, system theory, operations research, (16) mathematical logic, automata, program languages, data structures. Author

**N76-14820#** Research Inst. of National Defence, Stockholm (Sweden).
**TECHNICAL FORECAST 1974: COMPUTERS AND DATA HANDLING [TEKNISK PROGNOS 1974: DATORER OCH DATA BEHANDLING]**
Jacob Palme Jun. 1974 35 p In SWEDISH
(FOA-P-C-8404-M3(E5)) Avail: NTIS HC $4.00

A forecast for the future of data handling indicates very strong expansion and falling prices. Increasingly more applications become profitable for computers. Computer networks susceptible to disturbances are not uncommon. The large computer expansion begins to effect everyone and can give rise to new conflicts and social problems as well as new possibilities for free access to information. Certain difficult problems in the field of data treatment have restrained its growth, e.g. a lack of standardization, difficulties in making large computer systems available and problems in connection with communication between man and the computer. Author

**N76-14821#** Research Inst. of National Defence, Stockholm (Sweden).
**APPLICATIONS FOR THE INTERACTIVE COMPUTER DEC-10 [TILLAEMPNINGAR FOER DIALOGDATORN DEC-10]**
Staffan Carlsson and Bengt Soederlund May 1974 49 p refs In SWEDISH
(FOA-P-C-8403-M3(E5)) Avail: NTIS HC $4.00

Representations from various quarters have been made to FOA on the desirability of giving a comparison of the different fields of application and problems which use the technique offered by DEC-10. A survey of programs prepared in this interaction indicates that there exist a large number of associated programs and problem areas. A selection has been made from these representing some central areas of application. Author

**N76-14822#** Air Force Materials Lab., Wright-Patterson AFB, Ohio. Technical Operations Office.
**DATA ACQUISITION AND ANALYSIS OF LONG-TERM THERMO-AGING DEGRADATION DATA Technical Report, Feb. - Jun. 1974**
Dennis Wisnosky, Perry Cockerham, and John Crist May 1975 30 p refs
(AF Proj. 7340)
(AD-A013914; AFML-TR-74-257) Avail: NTIS CSCL 09/2

Computer support for laboratory experimentation is becoming increasingly important in all types of scientific research. The more complex an experiment becomes, the greater the need for computer calculation, control, and data acquisition. This report describes a particular data acquisition instrument control applications to an experiment in 'Thermo-aging'. Emphasis has been placed on installation and operation to aid in future applications of the data acquisition system. GRA

**N76-14823#** Army Computer System Command, Fort Belvoir, Va.
**COMBAT SERVICE SUPPORT SYSTEM TIMING STUDY Final Report**
William D. Kerns 1975 98 p refs
(AD-A013870; USACSC-ATS-75-01) Avail: NTIS CSCL 09/2

This report describes a study conducted to forecast the number of hours required to process the personnel, logistics, and maintenance software systems for a division using the Combat Service Support System (CS sub 3) IBM 360/30 hardware configuration under average to maximum workloads. These systems and their component subsystems range in state of development from the conceptual to operational, requiring use of separate forecasting methodologies based on the life cycle of the software. For the personnel system, linear regression techniques were used to predict runtimes based on expected volumes of input and output. A simulation model was constructed using the Computer Aided Systems Evaluation (CASE) package to predict runtimes for the logistics system. Runtimes for the maintenance system were predicted by CASE simulation and by analyst estimates. The conclusion of this study is that the CS sub 3 hardware system will be adequate under average workloads but may become saturated under maximum workloads. Several proposals which should lower the computer time requirements below the saturation levels are discussed. GRA

**N76-14824#** Naval Postgraduate School, Monterey, Calif.
**DESIGN APPROACH FOR A COMPUTER GRAPHICS SYSTEM APPLICABLE TO TORPEDO TRACKING AND EVALUATION M.S. Thesis**
Lee Neal Schofield Jun. 1975 58 p refs
(AD-A013660) Avail: NTIS CSCL 19/8

This paper presents a design approach and specific considerations for a dedicated, real time, interactive, computer graphics system to be used in the tracking and evaluation of torpedoes utilizing an input from a three-dimensional tracking range. The basic parameters for making output, software and hardware decisions are presented with alternative examples given in each area of the design process. Author (GRA)

**N76-14825#** Illinois Univ., Urbana. Dept. of Computer Science.
**ARCHITECTURAL CONSIDERATIONS IN THE DESIGN OF SPECIAL-PURPOSE MACHINES Ph.D. Thesis**
Leslie Norbert Daley May 1975 95 p refs
(Contract N00014-67-A-0305-0007)
(AD-A013679; UIUCDS-R-75-733) Avail: NTIS CSCL 09/2

In the first part of this thesis, the architectural development of a specific machine is presented. The experiences gained during this design project indicate that there is a 'best' system architecture for a given problem. Design options become available only on lower design levels, mainly in control units. The second part of the paper analyzes the choice between microprogrammed and hardwired realizations of control units. A model which predicts the costs of equivalent microprogrammed and hardwired control units is developed. This model predicts that the cost of a hardwired control unit will increase faster than that of its microprogrammed counterpart as the control signals which must be emitted become more complex. From the same foundations, a model for the reliability of both methods can be obtained. This model predicts that the reliability of a microprogrammed control is nearly independent of the control sequence. Hardwired control units, however, suffer from decreased reliability as control complexity grows. Author (GRA)

**N76-14826#** National Bureau of Standards, Washington, D.C. Systems and Software Div.
**EXPLORING PRIVACY AND DATA SECURITY COSTS. A**

**SUMMARY OF A WORKSHOP**
John L. Berg Aug. 1975 38 p
(COM-75-11113/8; NBS-TN-876; LC-75-600063) Avail: NTIS HC $4.00 CSCL 09B

On February 20, 1975, nine informed EDP professionals were invited by the Systems and Software Division of the Institute for Computer Sciences and Technology to discuss the costs Federal agencies should anticipate in complying with the Privacy Act of 1974. The invitees came from Federal agencies, private industry, and academe and shared an interest in the three questions posed by the day's agenda: (1) What benefits or increased value will EDP managers or data base administrators gain from implementing privacy requirements; (2) What direct or hidden costs can be identified and what processes can be used to identify costs; (3) How should costs be allocated among those who receive privacy's benefits or face its obligations? GRA

**N76-14827#** Naval Postgraduate School, Monterey, Calif.
**AN ANALYSIS OF A DIGITAL POSITIONING SYSTEM M.S. Thesis**
Yongyudha Nandidarbha Jun. 1975 133 p refs
(AD-A013663) Avail: NTIS CSCL 09/5

Digital techniques can be effectively and economically used for control purpose. A digital positioning system is simulated, studied, and the results compared with the results from a comparable analog system. Conventional compensation methods are used to compensate the comparable analog system and the results are used in simulation study of the digital system.
Author (GRA)

**N76-14828#** Naval Postgraduate School, Monterey, Calif.
**COMPUTER-AIDED DESIGN OF RECURSIVE DIGITAL NOTCH-FILTER WITH ONE COEFFICIENT M.S. Thesis**
Tran Truc Viet Jun. 1975 126 p refs
(AD-A013661) Avail: NTIS CSCL 09/2

A procedure for the design of a recursive digital notch-filter with one coefficient is proposed. This type of filter can be implemented readily with CCD (charge-coupled device). The effect of coefficient on notch-gain, notch-width, and passband-ripple is examined. The computer implementation is tested for second, third, and sixth order notch-filters and the optimum coefficient is found based upon limited computer wordlength. Author (GRA)

**N76-14829#** Naval Postgraduate School, Monterey, Calif.
**GENERALIZED APPROACH FOR EVALUATING DATA BASE ORGANIZATION AND INDEXING METHODS M.S. Thesis**
Rodolfo Mendiola Clautero Jun. 1975 54 p refs
(AD-A013628) Avail: NTIS CSCL 09/2

This paper is a study of data base organization and indexing methods with emphasis on the evaluation process. The approach of the study is focused on the data structure, a major characteristic of data base. Other aspects of the subject, indexing, for example, were discussed in relation to data structure. It was found that completeness and lucidity of knowledge of data base organization and indexing methods is necessary if one is to do a good job of evaluating a data base system. GRA

**N76-14830#** Optimum Computer Systems, Inc., New York.
**AN EVALUATION OF A CRYPTANALYTIC TECHNIQUE FOR THE RETRIEVAL OF ENGINEERING DATA Final Report, Jun. 1974 - Mar. 1975**
J. S. Nadan, Homi Cooper, and Stan S. Shoneman Mar. 1975 86 p
(Contract DAAA21-74-C-0542; DA Proj. 1E8-65803-M-728) (AD-A013610; Rept-700) Avail: NTIS CSCL 09/2

A program for the evaluation of selected cryptanalytic techniques for the retrieval of engineering data was conceived, designed and made ready for implementation. Utilization of cryptanalytic techniques allow the engineer to access a highly structured, fixed format data base via a free format English-language input query. Due to limited funds this test was not completed during this contract. Author (GRA)

**N76-14831#** Texas Univ., Austin. Electronics Research Center.
**TRANSIENT PROBABILITY MODELS OF COMPUTING SYSTEM DYNAMIC BEHAVIOR**
Wilfred S. Litzler and Baxter F. Womack 1 May 1975 126 p refs
(Contract F44620-71-C-0091; AF Proj. 9764; AF Proj. 6813) (AD-A013806; TR-170; AFOSR-75-1127TR) Avail: NTIS CSCL 09/2

The analysis of computing systems using mathematical models is most often concerned with the determination of long-term statistical trends or the prediction of steady-state probabilistic behaviour. Valuable insight into the dynamic operation of computing systems, however, is not always directly obtainable by such approaches. For this purpose, the application of certain transient probability models may be beneficial in some instances. A two-part investigation of transient probability models of computing systems is described. In the first investigation, the dynamic operation of a single peripheral processor as it performs an assigned task in a CDC 6600 computing system is studied. The transient analysis of queuing networks frequently used to model computing systems was studied in the second investigation. A probability flow technique for numerically analyzing networks of single queues is described. Models formulated by the method presented provide an enhanced level of detail not available in conventional queuing models. Three case studies are included to demonstrate the capabilities of this modeling technique. GRA

**N76-14832#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
**SYMPOSIUM ON ANALYTIC COMPUTATIONAL COMPLEXITY PROGRAM AND ABSTRACTS Interim Report**
J. F. Traub 8 Apr. 1975 31 p Symp. held at Pittsburgh, 7-8 Apr. 1975
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111; NR Proj. 044-422)
(AD-A014060) Avail: NTIS CSCL 12/1

This is the program and abstracts of invited and contributed papers presented at a Symposium on Analytic Computational Complexity on April 7-8. The full texts of the invited papers and abstracts of the contributed papers will be published in the Proceedings by Academic Press in Fall, 1975. GRA

**N76-14833#** Stanford Univ., Calif. Electronics Lab.
**OPTIMAL DATA COMPRESSION, FINITE MEMORY, AND JOINT SOURCE-CHANNEL ENCODING Interim Scientific Report, 1 May 1974 - 30 Apr. 1975**
Martin E. Hellman 1975 10 p refs
(Contract F44620-73-C-0065; AF Proj. 9749)
(AD-A013919; AFOSR-75-1032TR) Avail: NTIS CSCL 09/4

The research progress in two primary areas is reported: data compressive tree codes and multiuser communication networks.
GRA

**N76-14306*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**DOPPLER SPECTRUM EXTRACTION OF PLANETARY RADAR DATA USING COMPUTER FFT AND INTEGRATION**
D. E. Wallis *In its* The Deep Space Network 15 Oct. 1975 p 86-94 (For availability see N76-14296 05-31)
CSCL 09B

## 61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

**N76-14834** Ohio State Univ., Columbus.
**THE ARCHITECTURE OF A GRAMMAR-PROGRAMMABLE HIGH-LEVEL LANGUAGE MACHINE Ph.D. Thesis**
Serge Fournier 1975 274 p
Avail: Univ. Microfilms Order No. 75-26576

An architectural concept called grammar-programming is introduced. The term is applied to the context of a high level language machine and defines an intermediate level between the basic hardware/firmware functions of a computer system and its software language translators. Starting with fundamental definitions from the theory of formal languages, a model was developed to represent the syntactic and semantic characteristics

of context free language generators. The conversion of the generative grammar to a recognizer yields an automaton known as the syntax network. This formal model is characterized by a minimal set of well-defined and hardware implementable operations. Dissert. Abstr.

**N76-14835** British Library Lending Div., Boston Spa (England).
**STRUCTURED PROGRAMMING WITH COBOL**
M. A. Goetz [1975] 14 p Transl. into ENGLISH from Informat. Gestion (France), no. 59, Jul./Aug. 1974 p 85-89
(BLL-CE-Trans-6696-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

COBOL is considered unsuitable for structured programming. After defining what is meant by structured programming, a technique and discipline is described which improves the quality and the maintenance of programs while reducing the cost of programming. The modifications which must be made to COBOL and which, in fact, resulted in Metacobol are described. Author

**N76-14836** Saint Louis Univ., Mo.
**A COMPUTER ADAPTION OF LATTICE THEORY Ph.D. Thesis**
Patricia Mary Moore 1975 278 p
Avail: Univ. Microfilms Order No. 75-26290

Three matrix models are presented (easily codeable for a computer program) by which any lattice possessing a finite number of elements can be represented. Using these three models, different definitions and theorems from the geometry of lattices are expressed in terms of these models and coded for computer programs. It is shown that all lattices possessing a given number of elements can be generated in a computer program. The necessary mathematical background was developed for such a system, and some examples of computer programs which can be written within it are given. Dissert. Abstr.

**N76-14837** Florida State Univ., Tallahassee.
**CONTRIBUTIONS TO THE THEORY OF CONTINUOUS TIME PROGRAMMING Ph.D. Thesis**
Lanny Dale Larson 1975 72 p
Avail: Univ. Microfilms Order No. 75-26791

In both finite dimensional and continuous time programming there are two properties which form the basis for the theory: the existence of optimal solutions and duality. The theory is extended to a class of nonlinear continuous time problems which accommodate several economic models; continuous time analogues to theorems which are fundamental to finite dimensional programming theory were developed. A constraint qualification is constructed which is consistent with that found in finite dimensional programming. A continuous time version of the Farkas Theorem was developed and employed in conjunction with the constraint qualification to establish duality for a broad class of problems. This class is distinct from those previously examined and includes resource allocation as well as inventory and production problems. Dissert. Abstr.

**N76-14838** Stanford Univ., Calif.
**ON LARGE-SCALE LINEAR PROGRAMMING Ph.D. Thesis**
Markku Juhani Kallio 1975 118 p
Avail: Univ. Microfilms Order No. 75-25552

Three classes of methods were proposed for solving large-scale linear programs. First, sequential projection is applied to reformulate the linear program as a dynamic program. The dynamic programming recursion is solved by first approximating the return function at each stage using inner or outer linearization, and then gradually making the approximation more accurate until the correct optimal value for the linear program is found. Second, the revised simplex method utilizing a special factorization for the basis is considered. Third, a class of feasible direction methods is presented. Like the simplex method, these methods move from one feasible solution to another at each iteration. However, this feasible solution need not be an extreme point. A comparison of these three classes was also made. A probabilistic model was developed to estimate computational effort for matrix multiplications, and this model was applied to estimate computational effort for linear programming algorithms. Dissert. Abstr.

**N76-14839** Utah Univ., Salt Lake City.
**A SUBOPTIMAL SEARCH ALGORITHM FOR LINEAR CLASSIFICATION Ph.D. Thesis**
Anastasios Spyridon Politopoulos 1975 74 p
Avail: Univ. Microfilms Order No. 75-26049

A suboptimal search algorithm useful in nonseparable linear classification problems encountered in the areas of pattern recognition, mathematical programming, and threshold logic is described. The algorithm constitutes an iterative optimization scheme based on the geometrical structure implied by the classification problem. In effect, the algorithm attempts to maximize the number of consistent linear inequalities among a given set of such inequalities. This analytical criterion corresponds to minimizing the classification error of the pattern recognition problem. Experimental results indicate that the algorithm is an effective tool in tackling nonseparable problems and provides a deterministic and computationally tractable algorithm. It can be considered as an alternate solution to the nonseparable problem whose only other solution is provided by Mengert's random search technique. Dissert. Abstr.

**N76-14840** Texas Univ., Arlington.
**GPSE: A LANGUAGE FOR CREATING A GENERAL PURPOSE SIMULATION ENVIRONMENT Ph.D. Thesis**
Rajani Mohan Mahidhara 1975 178 p
Avail: Univ. Microfilms Order No. 75-27829

Simulation is a potential tool for the representation and evaluation of different systems. The development is described of a FORTRAN-based computer simulation language (the general purpose simulation environment) which can be used for the purpose of discrete simulation of different systems. The essential features of this language are: (1) the ability to stack more than one variable per computer work used; (2) its use of a logical processor for fast and efficient determination of system responses; (3) the ability to simulate either on a discrete event basis or on a discrete time basis depending on user option; and (4) a routine which, at the user's option, rearranges the variables being stored in the stack in such a manner as to obtain a near optimal size of the stack. GPSE was written essentially for execution on the IBM 360. Dissert. Abstr.

**N76-14841#** Research Inst. of National Defence, Stockholm (Sweden).
**OPTIMAL MEMORY ALLOCATION IN A SYSTEM WITH GARBAGE COLLECTION**
Stefan Arnborg May 1974 19 p refs
(FOA-P-C-8401-M3(E5)) Avail: NTIS HC $3.50

A storage allocation problem in the DEC-10 SIMULA object time system was solved. A model for the problem is presented. A number of mathematical approaches were used, and the validity of these approaches is discussed. The methods used are a continuous approximation of the discrete allocation problem, deterministic approximations, and stochastic renewal approximations. Author

**N76-14842#** Research Inst. of National Defence, Stockholm (Sweden).
**STRUCTURAL INDUCTION AND STRUCTURAL PROGRAMMING, PRACTICAL AND IMPRACTICAL METHODS FOR PROGRAM VALIDATION [STRUKTURERAD INDUKTION OCH STRUKTURERAD PROGRAMMERING - PRAKTISKA OCH OPRAKTISKA METODER FOER PROGRAMVALIDERING]**
Stefan Arnborg May 1974 55 p refs In SWEDISH; ENGLISH summary
(FOA-P-C-8402-M3(E5)) Avail: NTIS HC $4.50

Summary descriptions are given of simple formal methods for program validation, i.e. methods which may be used for a mathematical demonstration that a computer program has certain characteristics. The restrictions which must be introduced so that such proofs may be carried out, can also be regarded as a discipline in programming - structured programming - which facilitates program construction, even when the proof of their correctness is not fully carried out. After examining the theory of some applications, the methods' possible uses are discussed together with their place in program tuition and program work. The report has been prepared partly on memoranda from seminars and partly from experiences in implementing SIMULA for DEC-10. Author

**N76-14843*#** M&S Computing, Inc., Huntsville, Ala.
**HAL/SM SYSTEM FUNCTIONAL DESIGN SPECIFICATION**
C. Ross and G. P. W. Williams, Jr. 1 Dec. 1975 72 p refs
(Contract NAS8-26990)
(NASA-CR-144098; Rept-75-0044) Avail: NTIS HC $4.50 CSCL 09B

The functional design of a preprocessor, and subsystems is described. A structure chart and a data flow diagram are included for each subsystem. Also a group of intermodule interface definitions (one definition per module) is included immediately following the structure chart and data flow for a particular subsystem. Each of these intermodule interface definitions consists of the identification of the module, the function the module is to perform, the identification and definition of parameter interfaces to the module, and any design notes associated with the module. Also described are compilers and computer libraries. Author

**N76-14844*#** M&S Computing, Inc., Huntsville, Ala.
**HAL/SM SYSTEM SOFTWARE REQUIREMENTS SPECIFICATION**
C. Ross and G. P. W. Williams, Jr. 1 Dec. 1975 146 p refs
(Contract NAS8-26990)
(NASA-CR-144099; Rept-75-0045) Avail: NTIS HC $6.00 CSCL 09B

For abstract, see N76-14843.

**N76-14845*#** M&S Computing, Inc., Huntsville, Ala.
**HAL/SM LANGUAGE SPECIFICATION**
G. P. W. Williams, Jr. and C. Ross 21 Nov. 1975 253 p refs
(Contract NAS8-26990)
(NASA-CR-144100; Rept-75-0043) Avail: NTIS HC $9.00 CSCL 09B

A programming language is presented for the flight software of the NASA Space Shuttle program. It is intended to satisfy virtually all of the flight software requirements of the space shuttle. To achieve this, it incorporates a wide range of features, including applications-oriented data types and organizations, real time control mechanisms, and constructs for systems programming tasks. It is a higher order language designed to allow programmers, analysts, and engineers to communicate with the computer in a form approximating natural mathematical expression. Parts of the English language are combined with standard notation to provide a tool that readily encourages programming without demanding computer hardware expertise. Block diagrams and flow charts are included. The semantics of the language is discussed. Author

**N76-14846*#** Teledyne Brown Engineering, Huntsville, Ala.
**UPGRADING OF AMTRAN ON THE DATACRAFT DC 6024 Final Report, 16 Sep. 1974 - 21 Nov. 1975**
P. E. Beasley and K. S. Gregg Nov. 1975 17 p
(Contract NAS8-30779)
(NASA-CR-144106; APF75-NASA-01994) Avail: NTIS HC $3.50 CSCL 09B

A number of new software extensions and modifications to the AMTRAN system were completed. These modifications include input/output alterations, one-dimensional and two-dimensional array improvements, and disk storage of data enhancements. In order to promote a better understanding of the AMTRAN system software structure, a general description of the AMTRAN modules and their interrelationships was provided. A few sample statements have also been traced through the compilation and execution stages in order to illustrate the flow of system logic. In addition, the previous documentation was updated to reflect these modifications. Author

**N76-14847*#** Aerospace Corp., El Segundo, Calif. Information Processing Div.
**MANNED SYSTEMS UTILIZATION ANALYSIS (STUDY 2.1). VOLUME 4: PROGRAM MANUAL AND USERS GUIDE FOR THE LOVES COMPUTER CODE Final Report**
Stanley T. Wray, Jr. 1 Sep. 1975 151 p
(Contract NASw-2727)
(NASA-CR-145836; ATR-76(7361)-1-Vol-4) Avail: NTIS HC $6.75 CSCL 09B

Information necessary to use the LOVES computer program in its existing state or to modify the program to include studies not properly handled by the basic model is provided. A users guide, a programmers manual, and several supporting appendices are included. Author

**N76-14848*#** Aerospace Corp., El Segundo, Calif.
**MANNED SYSTEMS UTILIZATION ANALYSIS (STUDY 2.1). VOLUME 5: PROGRAM LISTING FOR THE LOVES COMPUTER CODE Final Report**
Stanley T. Wray, Jr. 1 Sep. 1975 80 p refs
(Contract NASw-2727)
(NASA-CR-145834; ATR-76(7361)-1-Vol-5) Avail: NTIS HC $5.00 CSCL 09B

The LOVES computer code developed to investigate the concept of space servicing operational satellites as an alternative to replacing expendable satellites or returning satellites to earth for ground refurbishment is presented. In addition to having the capability to simulate the expendable satellite operation and the ground refurbished satellite operation, the program is designed to simulate the logistics of space servicing satellites using an upper stage vehicle and/or the earth to orbit shuttle. The program not only provides for the initial deployment of the satellite but also simulates the random failure and subsequent replacement of various equipment modules comprising the satellite. The program has been used primarily to conduct trade studies and/or parametric studies of various space program operational philosophies. Author

**N76-14849#** Aerospace Corp., El Segundo, Calif. Technology Div.
**THE AIDS INVENTORY PROJECT Interim Report**
D. J. Reifer 16 Jul. 1975 71 p refs
(Contract F04701-74-C-0075)
(AD-A013737; TR-0075(5112)-8; SAMSO-TR-75-184) Avail: NTIS CSCL 09/2

This document reports the progress made in an effort directed towards establishing an aids inventory. The aids inventory will serve as a center for storage and distribution of support programs (i.e., simulators, analyzers, etc.) used for development, test, and maintenance of operational software at SAMSO. Preliminary conclusions based on the limited data collected for the 131 aids listed in the report are presented. GRA

**N76-14850#** Army Computer System Command, Fort Belvoir, Va.
**AN ALGORITHM FOR BLOCKING FACTOR OPTIMIZATION Final Report**
Larry A. Pickard and Marvin D. Raines 1 Jul. 1975 41 p refs
(AD-A013829; USACS-AT-75-03) Avail: NTIS CSCL 09/2

This report describes a performance enhancement study carried out to examine the impact of blocking factors on program run time in a fixed partition environment. Initial analysis is described to determine blocking factor behavior. The results of this analysis forms the basis for the development of a performance enhancement utility routine to automatically predict the best blocking assignment for tape and sequential disk files to minimize program run time. The derivation of the appropriate mathematical optimization algorithm and the underlying assumptions inherent in the algorithm are explained. Summary results and typical time savings from the use of the algorithm are provided to indicate the increase in resource utilization that can be realized from implementing the routine. Detailed procedures on how to use this tool are also provided. Author (GRA)

**N76-14851#** CACI, Inc., Los Angeles, Calif. Systems Programming Dept.
**A QUICK LOOK AT SIMSCRIPT II.5, 4TH ED. Final Report**
E. C. Russell and J. S. Annino Jul. 1975 30 p refs
(PB-243217/7; CACI-SI-75/01) Avail: NTIS HC $4.00 CSCL 09B

The Air Force, Navy, and Army have each sponsored implementations of the SIMSCRIPT II.5 simulation language. The II.5 modeling concepts are described and demonstrated in this document, through the use of three complete applications as follows: inventory control, queueing, and job shop. Each of the models is developed from a general problem description. Sample data and corresponding output is included. GRA

**N76-14852#** Research Inst. of National Defence, Stockholm (Sweden).
**PUTTING STATISTICS INTO A SIMULA PROGRAM**
Jacob Palme Jul. 1975 12 p
(PB-243785/3; FOA-1-C-1030-M3-E5) Avail: NTIS HC $3.50 CSCL 09B

Statements for outputting a trace of what happens during a simulation, and for collecting statistics to be output after the end of the simulation, should not clutter up the main logic of the simulation program. This paper shows with a simple example how a SIMULA program can be structured such that the tracing and statistics and the main logic of the simulation program are partitioned into different segments of the program. The paper will, at the same time, show the general facilities which SIMULA has for this kind of program structuring. GRA

**N76-14853#** Naval Research Lab., Washington, D.C.
**A FORTRAN PROGRAM FOR RAPID COMPUTATIONS INVOLVING THE NON-CENTRAL, CHI-SQUARE DISTRIBUTION Final Report**
Howard L. Wiener Aug. 1975 60 p refs
(NRL Proj. B02-26)
(AD-A014076; NRL-MR-3106) Avail: NTIS CSCL 12/1

A computer program has been developed for rapidly computing the non-centrality parameter in a statistical test of the chi-square distribution against a non-central chi-square alternative, when the number of degrees of freedom, the level of significance, and the power are all specified. The program produces results similar to those in previously published tables but operates with a marked saving in execution time. The program is well suited to implementation as part of a larger program, as part of a man-computer interactive system, or within a minicomputer. The report contains a program listing together with tables of computed values of the noncentrality. GRA

**N76-14854#** California Univ., Los Angeles. Computer Science Dept.
**RECENT COMPUTER SCIENCE RESEARCH IN LANGUAGE PROCESSING Interim Report**
Allen Klinger Jun. 1975 31 p refs
(Grant AF-AFOSR-2384-72; AF Proj. 9769)
(AD-A013856; UCLA-ENG-7541; AFOSR-75-1153TR) Avail: NTIS CSCL 09/2

The machine translation problem has recently been replaced by much narrower goals and computer processing of language has become part of artificial intelligence (AI), speech recognition, and structural pattern recognition. These are each specialized Computer Science research fields with distinct objectives and assumptions. The narrower goals involve making it possible for a computer user to employ a near natural-language mode for problem-solving, information retrieval, and other applications. Natural computer responses have also been created and a special term, 'understanding' has been used to describe the resulting computer/human dialogues. The purpose of this paper is to survey these recent developments to make the AI literature accessible to researchers mainly interested in computation on written text or spoken language. GRA

**N76-14855#** Naval Postgraduate School, Monterey, Calif.
**SOFTWARE ERROR DETECTION MODEL M.S. Thesis**
Thomas Frederick Green Jun. 1975 136 p refs
(AD-A013629) Avail: NTIS CSCL 09/2

A model of the error detection process for the testing of software has been developed to investigate the relationship between computer program structure and error detection and test effort. The model has been implemented as a simulation. GRA

**N76-14856#** North Carolina State Univ., Raleigh. Computer Science Dept.
**THE MPP SIMULATOR: USER'S MANUAL**
Yale N. Patt, William L. Albert, A. Mark Edwards, Alan L. Stewart, and Glenn L. Williamson Jun. 1975 54 p
(Contract DAAA25-74-C-0502; DA Proj. 1G6-63622-AJ-29)
(AD-A013830; FA-FCF-2-76) Avail: NTIS CSCL 09/2

This report represents the User's Manual for the CDC 5600 Micro-Programmable Processor Simulator. The host computers are the CDC 6000 series and the IBM 360 series. The simulator is written in Fortran for the CDC computer and in BAL for the 360 computer. The manual describes the simulator commands and options and a sample print out of the simulator being used is shown in Appendix II. Author (GRA)

**N76-14857#** University of Southern Calif., Marina del Rey. Information Sciences Inst.
**PROTOCOL ANALYSIS OF MAN-COMPUTER LANGUAGES. DESIGN AND PRELIMINARY FINDINGS: APPENDIX SUPPLEMENT**
Jul. 1975 176 p
(Contract DAHC15-72-C-0308)
(AD-A013656; ISI/RR-75-34) Avail: NTIS CSCL 09/2

The report contains appendices of simulator, consultant, and observer commands for logon-logoff messages for on line systems. GRA

# 62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

# 63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

**N76-14858** Cornell Univ., New York.
**STOCHASTIC INTEGRALS AND METADISTRIBUTIONS, APPLICATION TO STOCHASTIC PARTIAL DIFFERENTIAL EQUATIONS AND QUANTUM FIELD THEORY Ph.D. Thesis**
Roy Johnson King, Jr. 1975 44 p
Avail: Univ. Microfilms Order No. 75-27033

The Ito stochastic integral is extended to random fields, and stochastic differential equations are extended to stochastic partial differential equations. The approach is through an expansion of generalized functions to generalized functions on infinite dimensional vector spaces--metadistributions--so that the final space is nuclear. For n-dimensional random fields the natural infinite dimensional space is the space of n-dimensional tempered distributions. White noise at a point is realized as the delta function at that point. In this model the stochastic integral becomes the integral of the creation operator in quantum field theory. An extension of Ito's formula is proved for 2-dimensional random fields while extensions to higher dimensional random fields are obvious. Also proved are its equivalence with Ito stochastic integrals and several other properties. Canonical extensions to vector valued or nuclear space valued random fields are also demonstrated. Dissert. Abstr.

**N76-14859#** California Univ., Irvine. Systems Engineering and Operations Research Group.
**MINIMUM VARIANCE CONTROLS, CONFIGURED SYSTEMS Ph.D. Thesis**
Roger F. Roberts May 1975 69 p refs
(Grant AF-AFOSR-2116-71; AF Proj. 9769)
(AD-A013859; SEOR-75-2; AFOSR-75-1051TR) Avail: NTIS CSCL 12/1

The problem of optimal regulation for stochastic linear systems is examined and posed as a mathematical programming problem. The approach taken is that of simultaneously configuring both the plant and controller, thereby producing what is called a controls-configured system. A computational procedure, built around the Generalized Reduced Gradient algorithm, is developed using the state convariance as the measure of system regulation, hence yielding a minimum variance, controls-configured system design. Two examples are presented that illustrate the procedure in which regulation is improved by approximately 18% over that achievable with a fixed plant. The stabilization of a linear

time-invariant system is examined using state variable feedback. A mathematical programming algorithm is presented which permits the selection of a feedback gain matrix that yields, subject to a prescribed constraint set, a stable closed-loop solution. The technique is applied to a sample problem and appears well-suited for the stabilization problem. GRA

**N76-14860#** Brown Univ., Providence, R.I. Div. of Applied Mathematics.
**IDENTIFICATION OF LINEAR DIFFERENTIAL SYSTEMS ON A FINITE TIME INTERVAL WITHOUT ESTIMATING THE INITIAL STATE Interim Report**
A. E. Pearson 1975 27 p refs
(Grants AF-AFOSR-2078-71; NSF ENG-73-03846; AF Proj. 9769)
(AD-A013910; AFOSR-75-1048TR) Avail: NTIS CSCL 12/1

Linear algebraic equations are derived for identifying the parameters of a linear multivariable differential system based on input-output data observed noise-free over a finite time interval. The technique circumvents the need for estimating the initial state of the system. The formulation allows for unknown input disturbances to the extent that such disturbances can be modeled by the free response of a linear differential equation. It is shown that a unique solution is obtained only if the component functions of the input-output data, together with a certain number of their derivatives, are linearly independent on the observation interval. GRA

**N76-14861#** Brown Univ., Providence, R.I. Div. of Applied Mathematics.
**DISCRETE APPROXIMATIONS FOR STOCHASTIC CONTROL PROBLEMS WITH CONTROL ACTING CONTINUOUSLY AND IMPULSIVELY Interim Report**
Harold J. Kushner 1975 46 p refs Sponsored in part by ONR
(Grants AF-AFOSR-2078-71; NSF ENG-73-03846; AF Proj. 9769)
(AD-A013909; AFOSR-75-1049TR) Avail: NTIS CSCL 12/1

Stochastic control problems of either the optimal stopping or impulsive control type on diffusion models are considered, but there is also a continuously acting control. Various computationally convenient Markov chain approximations to the problems are developed, and it is shown that the costs for the sequence of approximations converge to the optimal cost for original problems. GRA

**N76-14862#** California Univ., San Diego. Dept. of Applied Mechanics and Engineering.
**ADAPTIVE OPTIMAL INPUT SYNTHESIS FOR LINEAR SYSTEM IDENTIFICATION Interim Report**
B. R. Upadhyaya and H. W. Sorenson 1975 8 p refs
(Grant AF-AFOSR-1809-69; AF Proj. 9769)
(AD-A013809; AFOSR-75-1093TR) Avail: NTIS CSCL 12/1

Optimal open-loop feedback formulation of the input synthesis problem for parameter estimation in linear dynamic systems is presented. The combination of recursive estimation and synthesis technique features a marked improvement in the behavior of estimates over the open-loop formulation. These methods are also applied in designing probing signals when the discrete a priori distribution of the parameters is known. GRA

**N76-14863#** California Univ., Irvine. Systems Engineering and Operations Research Group.
**LINEAR MULTIVARIABLE SERVOMECHANISMS**
C. A. Wolfe May 1975 74 p refs
(Grants AF-AFOSR-2116-71; NSF GK-39735; AF Proj. 9769)
(AD-A013874; SEOR-75-3; AFOSR-75-1050TR) Avail: NTIS CSCL 12/1

The object of this dissertation is the study of linear multivariable servomechanisms. The main thrust of the research is to extend the single-input/single-output concept of 'system type' to the multivariable (multi-input/multi-output) case. For the multivariable system, system type is given as a vector of numbers which represent the type of the individual input/output pairs. New methods are presented for determining the type of a multivariable transfer function both from the frequency domain and from the time domain descriptions of the system. The problem of designing compensators to create a transfer function of a specified type is considered. GRA

**N76-14864#** Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.
**STATISTICAL PATTERN RECOGNITION REVIEW AND OUTLOOK Interim Technical Report**
C. H. Chen 25 Jun. 1975 17 p refs
(Grant AF-AFOSR-2119-71; AF Proj. 9769)
(AD-A013615; EE-75-4; AFOSR-75-1148TR) Avail: NTIS CSCL 09/2

In spite of the vigorous efforts by researchers, statistical pattern recognition remains to be a field which is rich in challenging theoretical problems. In this paper, emphasis is placed on near future and future outlook of this field while examining the recent development of the field. Ten problem areas where the solutions are most wanted are listed as: feature extraction, nonstationary patterns, adaptive systems, learning complexity, finite sample size effects, computational recognition complexity, contextual analysis, optimum pattern recognizer, statistical and syntactic mixed model, and the automatic generation of recognition rules for complex patterns. These problem areas are closely examined and possible future approaches are suggested. It is pointed out that any breakthrough in solving these problems would probably require fertilization from other fields such as artificial intelligence, digital signal processing, etc. GRA

**N76-14865#** Michigan Univ., Ann Arbor. Computer Information and Control Engineering.
**MODELING AND IDENTIFICATION OF RELATIVELY SLOWLY VARYING SYSTEMS Ph.D. Thesis**
Philip Howard Fiske Apr. 1975 164 p refs
(Grant AF-AFOSR-2328-72; AF Proj. 9749)
(AD-A014002; UMICH-011306; AFOSR-75-1103TR) Avail: NTIS CSCL 21/1

This thesis is concerned with the modeling and identification of a large class of nonlinear, time-varying, causal, bounded memory systems. A generic model is developed for such time-varying systems, and this model is formulated in terms of a finite set of parameters which adequately describe the unknown system mapping. Two separate models are considered for the variation in the parameters representing the unknown system. In the first, the variation is assumed to be unknown but bounded between measurement times, and in the second, the variation between measurement times is taken to be random, with known mean and covariance. In each case, two methods of processing the observations are considered. GRA

# 64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

**N76-14866** Texas Technological Univ., Lubbock.
**BAYES AND EMPIRICAL BAYES ESTIMATION OF RELIABILITY FOR THE WEIBULL MODEL Ph.D. Thesis**
Mingwei George Lian 1975 170 p
Avail: Univ. Microfilms Order No. 75-26848

Bayes and empirical Bayes estimation techniques were used to obtain point and interval estimators for the reliability and mean time-to-failure of a two parameter Weibull failure model with known shape parameter. The estimation procedures were developed under the assumption of censored life testing. In the Bayesian procedure, a class of piecewise linear density functions was used as the prior family. In the empirical Bayesian procedure suitable kernal-type density estimators was used to estimate the unknown prior density function. These estimators are formed directly, by using a sequence of maximum likelihood estimates from related reliability experiments, without having to directly estimate the scale parameter of the Weibull failure model. The performance of these estimators is compared to that of the classical maximum likelihood estimators and Bayes estimators by use of Monte Carlo simulation techniques. Numerical examples are also given to demonstrate the use of these estimators. A significant mean square error improvement of the empirical Bayes

estimators over the maximum likelihood estimators was observed in the simulation results. Dissert. Abstr.

**N76-14867** Cincinnati Univ., Ohio.
**DIRECT AND INVERSE FREE BOUNDARY PROBLEMS BY INVERTED METHODS WITH APPLICATION TO ECM Ph.D. Thesis**
Robert Harold Nilson 1975 81 p
Avail: Univ. Microfilms Order No. 75-28841

Direct and inverse free boundary problems for the two-dimensional Laplace equation are formulated by the inverted approach in which the spacial coordinates are treated as the dependent variables on the plane of the complex potential. The direct problem which consists of finding the location of the free surface in accordance with the given position of fixed boundaries is solved by an alternating field technique in which the inverted problems for each of the space variables are successively solved by finite differences in a cyclical fashion so that unknown boundary conditions can be iteratively improved. In illustrative applications to electrochemical machining (ECM), the steady-state geometric relationship between the tool and workpiece can be determined either by solving the direct problem for a prescribed tool shape or the inverse problem for a prescribed worksurface, for either non-insulated or partially insulated tool configurations, and even for variable electrolyte conductivity. Application of the methods in other areas of engineering such as heat transfer and fluid flow is also discussed. Dissert. Abstr.

**N76-14868** Michigan Univ., Ann Arbor.
**BOUNDARY VALUE PROBLEMS FOR NONLINEAR ORDINARY DIFFERENTIAL EQUATIONS Ph.D. Thesis**
Richard Kent Nagle 1975 127 p
Avail: Univ. Microfilms Order No. 75-29296

The solution is discussed of nonlinear boundary value problems at resonance, when the associated homogeneous linear boundary value problem has a solution. Dissert. Abstr.

**N76-14869** Case Western Reserve Univ., Cleveland, Ohio.
**LIBRARY TYPE MARKOV CHAINS Ph.D. Thesis**
Peter Reid Nelson 1975 53 p
Avail: Univ. Microfilms Order No. 75-27944

In a single-shelf library of N books the books are removed one at a time, examined, and replaced at the left-hand end of the shelf prior to the next removal. Book B sub i is selected with fixed probability P sub i, and selections are assumed independent. The different arrangements of books on the shelf are considered as states in a Markov chain. This model is extended to many shelves, when N less than infinity the stationary distribution of the Markov chain is found; when N = infinity, and there is at least one shelf with only finitely many books, the chain is shown to be nonergodic. For the single-shelf case, the following are found: the variance of the position of B sub i, a prediction interval for the position of B sub i, the Martin exit boundary, the generating function for the distribution of first entrance, the expected time of first entrance, and the limits of ratios of individual transition probabilities. The single-shelf model is generalized by giving the books a geometric holding time. That is, if a book is not on the shelf, it is returned with probability p prior to the next selection. Dissert. Abstr.

**N76-14870#** Research Inst. of National Defence, Stockholm (Sweden).
**FORTRAN SUBROUTINES TO SOLVE THE LYAPUNOV AND THE RICCATI MATRIX EQUATIONS**
Johan Svartengren Feb. 1974 16 p refs
(FOA-2-C-2655-E4-E5) Avail: NTIS HC $3.50

Subroutines to solve the discrete time Lyapunov and Riccati equations found in Kalman filtering theory are presented. The subroutines use a matrix handling package which has been extended. The routines are written in standard FORTRAN and may be implemented on most computer installations. Author

**N76-14871#** Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
**PROJECTIVITY OF FINITELY-GENERATED FLAT MODULES**
I. I. Sakhaev 1975 17 p refs Transl. into ENGLISH from Sibirskii Mat. Zh. (USSR), v. 6, no. 3, 1965 p 564-573
(NRC/CNR-TT-1827) Avail: NTIS HC $3.50

An investigation was conducted which shows that any finitely-generated left lambda-flat module is lambda-projective, if and only if, for any n, the matrix ring lambda sub n over lambda satisfies the boundary minimality or maximality conditions for the principal ideals. Author

**N76-14872#** Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
**APPROXIMATION IN FINITE ELEMENT MODELS. 1. GENERAL THEORY FOR LINEAR PROBLEMS**
Fumio Kikuchi Sep. 1975 34 p refs
(ISAS-531) Avail: NTIS HC $4.00

A general theory of convergence of finite element solutions is presented. Common properties of existing finite element models are clarified especially with respect to the behavior of discretization errors. Various models are unified in an abstract manner to propose a method of error analysis for linear boundary-value and eigenvalue problems. Two concrete schemes for plate bending are analyzed, and numerical results are shown to see the validity of the theory. Author

**N76-14873#** Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
**FENCHEL'S HYPOTHESIS AND THE EXISTENCE OF RECESSION DIRECTIONS IN CONVEX PROGRAMMING**
Elmor L. Peterson 2 Jun. 1975 28 p refs
(Grant AF-AFOSR-2516-73; AF Proj. 9749)
(AD-A013118; AFOSR-75-1055TR; Paper-152) Avail: NTIS CSCL 12/1

Given a consistent convex programming problem and one of its dual problems, Fenchel's hypothesis for the dual problem is related to the existence of recession directions and a nonempty bounded optimal solution set for the primal problem.
Author (GRA)

**N76-14874#** Rice Univ., Houston, Tex. Dept. of Mechanical Engineering.
**NEW TECHNIQUES IN NUMERICAL ANALYSIS AND THEIR APPLICATION TO AEROSPACE SYSTEMS Final Report, 1 Sep. 1974 - 31 Aug. 1975**
Angelo Miele 1975 23 p refs
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-A013844; AFOSR-75-1176TR) Avail: NTIS CSCL 12/1

The objective of this investigation is to contribute to numerical techniques of interest in systems theory in general and aerospace engineering in particular. Typical areas of mathematical research are: (a) solution of nonlinear, algebraic or transcendental, equations, (b) solution of nonlinear, ordinary differential equations, (c) mathematical programming problems, and (d) optimal control problems. Typical areas of application are: (1) numerical solution of optimum flight trajectories and (2) numerical solution of optimum aerodynamic shapes. Algorithms for digital computer have been developed and tested on IBM 370/155. GRA

**N76-14875#** Colorado Univ., Boulder. Dept. of Mathematics.
**ANALYSIS OF CONVERGENCE AND TRUNCATION ERROR OF EXPANSIONS OF FUNCTIONS OF AEROSPACE PHYSICS AND ENGINEERING Final Report, 1 Jun. 1970 - 30 May 1975**
Wolfgang J. Thron and William B. Jones 1 Aug. 1975 16 p refs
(Grant AF-AFOSR-1888-70; AF Proj. 9749)
(AD-A013805; AFOSR-75-1175TR) Avail: NTIS CSCL 12/1

This research deals mainly with convergence, speed of convergence, and truncation error estimation of Pade approximants and continued fractions and of the application of these and other known results to expansions of functions of aerospace physics and engineering. It is also concerned with the development of algorithms and computational techniques to aid in the practical application of the methods. The research problems and results involve the general areas of numerical and computational analysis, approximation methods, applied complex analysis, special functions, and the analytic theory of Pade approximants and continued fractions. GRA

**N76-14876#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.

**MAXIMAL ORDER OR MULTIPOINT ITERATIONS USING N EVALUATIONS Interim Report**
Jul. 1975 36 p refs
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111; NR Proj. 044-422)
(AD-A013604) Avail: NTIS CSCL 12/1

Multipoint iterations without memory for the solution of the nonlinear scalar equation $(f(m))(x)=0$, m greater than or equal to 0. Let (p sub n)(m) be the maximal order of iterations which use 'n' evaluations of the function or its derivatives per step. The Kung and Traub conjecture (p sub n)(0)= 2(n-1) for Hermitian information is proven. The problem of the maximal order is connected with Birkhoff interpolation; under a certain assumption, the Polya conditions are found to be necessary for maximal order. Author (GRA)

**N76-14877#** Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
**ON MINIMAX MULTISTAGE PERMANENT ELIMINATION TYPE RULES FOR SELECTING THE LARGEST NORMAL MEAN**
Ajit C. Tamhane May 1975 175 p refs
(Contracts DAHC04-73-C-0008; N00014-67-A-0077-0020)
(AD-A014062; TR-259) Avail: NTIS CSCL 12/1

The problem of selecting the population associated with the largest mean from $k > or = 2$ normal populations is considered in the context of the indifference-zone approach. GRA

**N76-14878#** Carnegie-Mellon Univ., Pittsburgh, Pa.
**MULTIPLE-PRECISION ZERO-FINDING METHODS AND THE COMPLEXITY OF ELEMENTARY FUNCTION EVALUATION Interim Report**
Richard P. Brent Jul. 1975 29 p refs Prepared in cooperation with Australian Natl. Univ.
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111; NR Proj. 044-422)
(AD-A014059) Avail: NTIS CSCL 12/1

The author considers methods for finding high-precision approximations to simple zeros of smooth functions. As an application, the author gives fast methods for evaluating the elementary functions log(x), exp(x), sin(x) etc. to high precision. For example, if x is a positive floating-point number with an n-bit fraction, then (under rather weak assumptions) an n-bit approximation to log(x) or exp(x) may be computed in time asymptotically equal to 13M(n) log of n to the base 2 as n approaches infinity, where M(n) is the time required to multiply floating-point numbers with n-bit fractions. Similar results are given for the other elementary functions, and some analogies with operations on formal power series are mentioned. GRA

**N76-14879#** Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
**A CLASS OF OPTIMAL-ORDER ZERO-FINDING METHODS USING DERIVATIVE EVALUATIONS Interim Report**
Richard P. Brent Jun. 1975 18 p refs Prepared in cooperation with Australian Natl. Univ.
(Contract N00014-67-A-0314-0010; Grant NSF GJ-32111; NR Proj. 044-422)
(AD-A014058) Avail: NTIS CSCL 12/1

It is often necessary to find an approximation to a simple zero zeta of a function f , using evaluations of f and f' . In this paper the author considers some methods which are efficient if f' is easier to evaluate than f . Examples of such functions are given. GRA

## 65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

**N76-14880** South Dakota Univ., Vermillion.
**PHYSICAL AND GEOMETRICAL APPROACH TO STATISTICAL CONCEPTS Ph.D. Thesis**
Assad Barari 1975 90 p
Avail: Univ. Microfilms Order No. 75-28904

The development of explanatory materials for basic statistical concepts was studied. The increased use of statistics in education and other fields makes it necessary for students to study statistics. Some students either do not have a rigorous background in mathematics or, because of the time element, they have forgotten much of the mathematics they knew. As a result, they memorize formulas instead of understanding concepts. Faced with a problem, they can not decide which formula is the proper one to use. The intention is to show that statistical formulas are tools, and not the goals for better understanding of numerical data. A detailed study of the present elementary text books, available at the University of South Dakota Library, was undertaken to identify commonly used concepts in the first course of statistics. These concepts are presented by the application of physical sciences or by using analogies from everyday life. Dissert. Abstr.

**N76-14881** Temple Univ., Philadelphia, Pa.
**GENERALIZED BETA DISTRIBUTION - ESTIMATION, PROPERTIES AND APPLICATIONS Ph.D. Thesis**
George C. Kattakkuzhy 1975 107 p
Avail: Univ. Microfilms Order No. 75-28228

Properties of the distribution and a characterization are derived. The shape of the distribution as the parameters change and the limiting distribution as p approaches 0 are discussed. Properties of beta distribution such as the product rule are shown to be carried over to the generalized beta distribution. In estimating the parameters of the distribution two moment estimators of 'c' are derived, and the efficiency for various values of the parameters were obtained. Solutions of the maximum likelihood equations were obtained. A bivariate density is considered in which the failure time under stress conditions follows ordinary beta distribution of the second kind and the failure time under normal environment follows generalized beta distribution. Some properties of the bivariate density are derived, and various estimation procedures are discussed. Dissert. Abstr.

**N76-14882#** Research Inst. of National Defence, Stockholm (Sweden).
**A STUDY OF SOME POLYNOMIALS ASSOCIATED WITH THE BIVARIATE NORMAL DISTRIBUTION**
Staffan Wrigge Jan. 1974 38 p refs
(FOA-P-C-8384-M6) Avail: NTIS HC $4.00

Let X and Y be a pair of bivariate normally distributed random variables. Different techniques are considered for evaluating the mean value E(p(X)q(Y)), where p(x) and q(y) denote polynomials of arbitrary degree. Special interest is devoted to the case E(X(k)Y(2n-k)) since the resulting polynomials are related to Gegenbauer polynomials. Author

**N76-14883#** Wisconsin Univ., Madison. Dept. of Statistics.
**STATISTICAL MODELS FOR TIME SERIES AND LIFE TESTING WITH APPLICATION IN ENGINEERING SYSTEMS Annual Report, 1 Jun. 1974 - 31 Mar. 1975**
G. E. P. Box, John Gurland, G. K. Bhattacharyya, Richard A. Johnson, and Grace Wahba 1975 12 p refs
(Grant AF-AFOSR-2363-72; AF Proj. 9769)
(AD-A013871; AFOSR-75-1190TR) Avail: NTIS CSCL 12/1

The paper presents results on the continuing interest in system reliability and life testing and in stochastic systems with applications in closed loop control, forecasting, model building, smoothing and curve estimation. Also included in this period was a study on the extent of distortion on statistical inferences caused by violation of assumptions. Considerable progress has been made on the topic of estimation of stochastic and dynamic parameters from data collected for a system under feedback control. GRA

**N76-14884#** Technology, Inc., Dayton, Ohio.
**LINEAR INVARIANT PREDICTION OF ORDER STATISTICS IN LOCATION AND SCALE FAMILIES Interim Report, 20 May - 16 Aug. 1974**
Kenneth S. Kaminsky, Nancy R. Mann, and Paul I. Nelson Wright-Patterson AFB, Ohio ARL Jun. 1975 20 p refs
(Contracts F33615-73-C-4155; F44620-71-C-0029; AF Proj. 7071)
(AD-A013688; ARL-75-0151) Avail: NTIS CSCL 12/1

Identical items are simultaneously subjected to stress and operate independently until failure. The authors observe the early failures and use the times of these failure to predict the

times of later failures in the same sample. Best linear invariant predictors are derived for location-scale families of failure time distributions, and two simplified predictors are developed. The relative behavior of the predictors is indicated in a table. GRA

**N76-14885#** North Carolina Univ., Chapel Hill. Dept. of Statistics.
**AUTOMATA IN ENVIRONMENTS, 3. RANDOM ENVIRONMENTS Ph.D. Thesis**
Jerren Gould 1975 24 p refs
(Grant AF-AFOSR-2840-75; AF Proj. 9769)
(AD-A013872; AFOSR-75-1191TR) Avail: NTIS CSCL 12/1

This paper considers the case of automata operating within random environments. This formulation of automata in random environments is useful when only certain probabilistic assumptions about the occurrence of any environment configuration can be made or when the environment configuration can only be measured by statistical techniques. GRA

**N76-14886#** California Univ., Los Angeles. Dept. of Biomathematics.
**CONTAMINATION PROBABILITY OF ORDER STATISTICS Final Report, 29 Jun. 1973 - 31 Dec. 1974**
V. K. Murthy 15 Aug. 1975 25 p refs
(Contract N00014-69-A-0200-4049)
(AD-A014036) Avail: NTIS CSCL 12/1

Given that an arbitrary number of observations are contaminated, explicity expressions are obtained for the probability of the ith smallest observation in the sample to be the jth smallest contaminated one. The probabilities are tabulated for the cases up to three contaminating observations for samples from a normal distribution with either scalar or location contamination. It is also shown that for large samples the corresponding normal approximation for the multinomial may be used for approximating the contaminating probabilities. GRA

# 66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

**N76-14887** Arkansas Univ., Fayetteville.
**EXTENSIONS OF INVENTORY THEORY PROBLEMS WITH DETERMINISTIC DEMAND Ph.D. Thesis**
David Forrest Byrd 1975 110 p
Avail: Univ. Microfilms Order No. 75-27687

The development of improved solution procedures for the deterministic economic lot-sizing problem was dealt with. These solution algorithms are developed not only with regard to optimality of results but also with consideration for computational speed and efficiency. An alternate formulation is presented which expresses Wagner and Whitin's dynamic economic lot-sizing model as a network. After the characteristics of this inventory network are discussed, a general solution algorithm is presented. When means of improving the efficiency of the algorithm by applying the p-restraint and Wagner-Whitin constraint are discussed. A new backward solution algorithm is developed which utilizes the special characteristics of the inventory network. The mode eliminating capabilities of its 'look-ahead' feature are discussed and a proof of the basis for this feature is presented. Dissert. Abstr.

**N76-14888** Southern Methodist Univ., Dallas, Tex.
**PRINCIPAL COMPONENT APPROACH TO HANDLING MULTICOLLINEARITY IN REGRESSION ANALYSIS Ph.D. Thesis**
Edward Richard Mansfield 1975 109 p
Avail: Univ. Microfilms Order No. 75-29142

Principal components, a multivariate tool for analyzing dependence structures in multivariate analysis, can be adapted to linear regression analysis. The transformation of regressor variables into components is only an intermediate step in the analysis; the principal components estimators can be easily expressed in terms of the original variables. The effect of the multicollinearity can be removed by deleting components associated with small latent roots of the correlation matrix of the regressor variables. Deleting any other components results in the addition of an unnecessarily large amount of bias to the estimators particularly to coefficients of the variables not involved in the multicollinearity. When the effect of the multicollinearity is removed, a variable selection procedure can be used in many instances to determine correctly an optimum subset of the original independent variables. Dissert. Abstr.

**N76-14889** California Univ., Los Angeles.
**SPECIAL STRUCTURES IN NETWORK MODELS AND ASSOCIATED APPLICATIONS Ph.D. Thesis**
John Michael Mulvey 1975 296 p
Avail: Univ. Microfilms Order No. 75-26973

Optimization techniques have been generally limited to moderate size, well defined applications. Several network related algorithms are described and tested. These techniques are inexpensive to run and can readily resolve large scheduling and allocation problems; for example, problems with 10000 nodes and 35000 arcs can be solved routinely. In addition to these computational efficiencies, a network serves as an ideal basis for an integrated optimization/information system, and this notion is applied to the fuzzy environment of scheduling faculty members of course offerings within an academic department. Experiences with the system are discussed. Also, it is shown that other ill-defined problems can be addressed by embedding a network model within a branch and bound framework or a heuristic setting. Several examples are presented, including the traditional set partitioning/covering problems and the classroom/time assignment model. Dissert. Abstr.

**N76-14890#** Houston Univ., Tex. Dept. of Electrical Engineering.
**AN ALGEBRAIC METHOD FOR MULTIVARIABLE MISSILE SYSTEM ANALYSIS AND SYNTHESIS Final Report, 1 Jun. 1974 - 31 May 1975**
Leang-San Shieh 30 Jun. 1975 71 p refs
(Contract DAHC04-74-G-0145)
(AD-A013530; AROD12540.7-EL-A) Avail: NTIS CSCL 16/4

Missile systems are typical multivariable control systems with few available practical approaches in the frequency domain. A frequency approach is developed in this research which makes use of an algebraic procedure for the analysis and synthesis of multivariable control systems. The newly developed matrix Cauer forms are used as bases for the investigation. The topics involved in this research can be outlined as follows: (1) the state-of-the-art is reviewed and research problems are identified, (2) 3 Cauer forms and the matrix Cauer forms are derived and extended, (3) properties and applications of the matrix Cauer forms are discussed. GRA

**N76-14891#** Stanford Univ., Calif. Optimization Lab.
**SPECIALLY STRUCTURED MATHEMATICAL PROGRAMMING PROBLEMS Interim Report, 1 Jun. 1974 - 31 May 1975**
16 Jul. 1975 8 p
(Contract F44620-74-C-0079)
(AD-A013581; AFOSR-75-1149TR) Avail: NTIS CSCL 12/2

The major results concern the solution of multi-stage capital budgeting problems complicated by incomplete information, by uncertainity, and by other factors, with emphasis on making it possible to explicitly consider probable future alternative projects, and the solution of certain classes of large-scale convex quadratic programming problems related to variational inequalities. GRA

**N76-14892#** Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group.
**SOME STRUCTURE AND BASIS THEOREMS FOR INTEGRAL MONOIDS**
Robert G. Jeroslow Jul. 1975 36 p refs
(Contract N00014-67-A-0314-0007; Grant NSF GP-37510; NR Proj. 047-048)
(AD-A013975; RR-367) Avail: NTIS CSCL 12/2

The author considers sets of integer vectors containing the zero vector and closed under addition, the integral monoids, and provides conditions under which they contain a finite subset of integer vectors which generate the entire monoid as non-negative integer combinations. It is also shown that integral monoids, which have a finite subset of the type just described,

can be represented as the sum of a group and a monoid whose convex span is a pointed cone. The paper concludes with some applications to the theory of integer programming. GRA

**N76-14310*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Network Operations Office.
**OPERATIONS ANALYSIS OF INTERMEDIATE DATA RECORD PRODUCTION IN THE VIKING ERA**
D. C. Card *In its* The Deep Space Network 15 Oct. 1975 p 191-204 (For availability see N76-14296 05-31)
CSCL 12B

# 67 THEORETICAL MATHEMATICS

Includes topology and number theory.

**N76-14893** Kent State Univ., Ohio.
**ON TORSION THEORIES GENERATED BY IDEALS Ph.D. Thesis**
Joseph Charles Thomas 1975 109 p
Avail: Univ. Microfilms Order No. 75-27827

Special hereditary torsion theories (the Goldie torsion theory and the simple torsion theory) were investigated in terms of their corresponding filter being an F(I) for some ideal I. Necessary and sufficient conditions are given for the Goldie torsion class to be closed under taking direct products. Investigation of stable hereditary torsion theories with filter F yields the existence of another filter G sub F closely associated to F. Under the stability condition, results concerning the homological dimensions of modules were obtained. A connection between stability and cyclic splitting was established. Dissert. Abstr.

**N76-14894** New York Univ., N.Y.
**PRECESSION IN GENERAL RELATIVITY Ph.D. Thesis**
Abbas Madjd Faridi 1975 89 p
Avail: Univ. Microfilms Order No. 75-28528

A generalization of Killing's equation was made in connection with the concept of precession. The vector field which generates groups of transformations leading to metrical deformations of space-time manifolds is examined. An invariant definition of precession was proposed which reduces to a familiar form in nonrelativistic situations. Symmetry groups (groups of motion) are discussed as being adequate description of time-independent linear integrals of geodesic motion and nonsymmetry groups (groups of deformations) are shown to be suitable for interpreting gravitational fields which are not highly symmetric, in particular for space-times admitting linear integrals depending on time explicitly. The special case of uniform precession is examined. For the case of uniform precession, an n-dimensional flat space solution was obtained, and a theorem establishing the condition under which the solution exists was proven. Several solutions of these equations on two-dimensional Riemannian spaces are given and in particular a deformed spherical surface was constructed. The geometrical properties of these solutions are discussed. A second order linear system of equations is also discussed. Dissert. Abstr.

**N76-14895** Temple Univ., Philadelphia, Pa.
**ANALYTICALLY INVARIANT SPACES IN SPECTRAL DECOMPOSITIONS OF LINEAR OPERATORS IN BANACH SPACES Ph.D. Thesis**
Ridgley E. Lange 1975 83 p
Avail: Univ. Microfilms Order No. 75-28180

A number of properties are established of analytically invariant spaces in the sense of Frunza, showing that these spaces enjoy very many properties possessed by the spectral maximal space due to Foias. With the help of analytically invariant spaces, a new class of operators on Banach space is introduced, the analytically decomposable operators, which are defined in a manner similar to the decomposable operators of Foias. Extensive consequences of this notion are treated. It is shown that the class of analytically decomposable operators is closed under application of the functional calculus. An appendix sets forth a result on algebras of almost decomposable operators similar to some theorems of Dunford on spectral operators. Applications of the above theory to various other classes of decomposable operators of Foias, Jafarian and Plafker are considered. A new characterization of decomposable operators (in the Foias sense) is given, and a criterion that an operator have finite spectrum is derived. Dissert. Abstr.

**N76-14896#** Aerospace Research Labs., Wright-Patterson AFB, Ohio.
**A TOPOLOGICAL ANALYSIS RESEARCH AND DEMONSTRATION COMPUTER PROGRAM LIBRARY Final Report, 1 Aug. 1972 - 1 Aug. 1974**
Kenneth O. Leland Jun. 1975 142 p refs
(AF Proj. 7071)
(AD-A013683; ARL-75-0155) Avail: NTIS CSCL 12/1

This report describes a computer program designed to operate in either batch mode or interactive conversational mode, created for the purposes of demonstrating certain aspects of the foundations of complex function theory and of facilitating research therein. The program is built around the concept of winding number which it relates to the concept of integer valued analogue of the complex analytic logarithm function. This number counts the number of times a closed path in the plane 'winds' about a point. It can be expressed in terms of concepts of combinatorial topology or analytically in terms of complex contour integrals or complex logarithm functions. A detailed set of instructions on how to use the program as well as a listing of the program coding is included. GRA

# 70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

**N76-14897** New Mexico Univ., Albuquerque.
**A FINITE PARTICLE RADIUS IN ELECTRODYNAMICS AND QUANTUM MECHANICS Ph.D. Thesis**
Henry Clarence Monteith 1975 114 p
Avail: Univ. Microfilms Order No. 75-28687

A potential, derived from considerations in five dimensional relativity theory, was studied. A review is made of early attempts to describe the electron theoretically and of the work of Holtzhauser. The potential is applied to problems of quantum mechanics. Electron scattering cross-sections were found in born approximation. The potential is generalized to include more than one particle and the analogue of the Lienard Wiechert potentials is found. Applications center on radiation problems. Specifically, the question of bremsstrahlung and the virtual photon concept are examined. Ideas are set down in order to indicate theoretical approaches to the illusive problem of developing a Unified Field Theory that fits nature. The concept of torsion, is briefly examined and an appendix is provided to explain its origin. Dissert. Abstr.

**N76-14898** New York Univ., N.Y.
**BOUNDARY LAYER ANALYSIS ON EQUATIONS OF BROWNIAN MOTION IN A FORCE FIELD Ph.D. Thesis**
Neil Barry Bromberg 1975 50 p
Avail: Univ. Microfilms Order No. 75-28511

The asymptotic analysis of the equations of Brownian motion as treated by Ilin and Khasminskii is extended to include boundaries. By probabilistic methods the boundary layer is analyzed and the boundary condition for the interior solution is derived. It is proven that the interior solution is a uniform approximation inside a compact subset of the region and for times bounded away from zero and infinity. This result is proven for half plane and convex polygonal regions. Dissert. Abstr.

**N76-14899#** Research Inst. of National Defence, Stockholm (Sweden).
**EFFICIENT NUMERICAL METHODS FOR SOLVING WAVE PROPAGATION EQUATIONS FOR NON-HOMOGENEOUS MEDIA**
Arne Sundstroem May 1974 51 p refs
(FOA-4-C-4576-A2) Avail: NTIS HC $4.50

Based on recent results of efficient numerical schemes for hyperbolic systems of partial differential equations, methods for predicting wave propagation in homogeneous and nonhomogen-

eous media are described. The case of a stratified structure with interface discontinuities of different order is treated. Author

# 71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

**N76-14900** Massachusetts Univ., Amherst.
**MEASUREMENT OF ACOUSTIC ABSORPTION COEFFICIENTS BY THE TONE-BURST METHOD IN A NOISY ENVIRONMENT Ph.D. Thesis**
William James Webster 1975 154 p
Avail: Univ. Microfilms Order No. 75-27560

The tone-burst method was proposed as a means of measuring the absorption of acoustical materials in the presence of environmental factors, for example a strong tangential flow of air which would result in a noisy test environment. Mathematical models were developed to determine the effects of the pulse parameters, duration and bandwidth, and of the properties of the material on the accuracy of the measurements. These models are tested by a carefully controlled analog experiment. Finally the tone-burst method is applied to a typical acoustical material in both quiet and noisy surroundings and the results are compared to impedance tube measurements of the same material. It was concluded that the tone-burst technique is capable of measuring acoustic absorption in either quiet or noisy conditions.
Dissert. Abstr.

**N76-14901** Georgia Inst. of Tech., Atlanta.
**A THIRTY CHANNEL REAL TIME AUDIO ANALYZER AND ITS APPLICATIONS Ph.D. Thesis**
Joel Thomas Kalb 1975 112 p
Avail: Univ. Microfilms Order No. 75-26209

Sound pressure levels in enclosed spaces are measured in a variety of ways. One which is particularly useful is a spectrum analysis in real time. Here a set of contiguous bandpass filters separate the signal into a collection of frequency bands. Then a corresponding set of detectors convert these bands to fluctuating rms equivalent values. Finally a multiplexer samples these quantities for a logarithmic display of the sequential band averages. This prompt and continuous representative spectrum allows effective analysis and modification of the properties of acoustic systems. This research interprets the spectrum average value in terms of the characteristics of realizable electrical networks and employs recently developed integrated circuitry to construct an analyzer having optimum performance. Dissert. Abstr.

**N76-14902#** California Inst. of Tech., Pasadena. Graduate Aeronautical Labs.
**MEASUREMENTS OF RADIATED NOISE IN THE CALTECH HIGH-SPEED WATER TUNNEL. PART 2: RADIATED NOISE FROM CAVITATING HYDROFOILS Final Report**
Steven J. Barker 20 Mar. 1975 47 p refs
(Contract N00014-67-A-0094-0028; NR Proj. 062-462)
(AD-A014008) Avail: NTIS CSCL 20/1

This paper is the second part of a report on recent measurements of hydrodynamic noise in the Caltech High-Speed Water Tunnel. In the first part, results for noise radiated from fully wetted turbulent boundary layers were presented. In this part the results for cavitating flows are described. Because of the greater intensity of cavitation-produced noise, the signal to noise, ratio was much higher in these measurements than in the fully wetted case. Noise spectra were measured over a range of variations of flow velocity, cavitation number, and model configuration. GRA

**N76-14903#** ARO, Inc., Arnold Air Force Station, Tenn.
**AN EXPERIMENTAL INVESTIGATION OF TECHNIQUES TO SUPPRESS EDGETONES FROM PERFORATED WIND TUNNEL WALLS Final Report, 19 Sep. 1972 - 20 Dec. 1974**
N. S. Dougherty, Jr., C. F. Anderson, and R. L. Parker, Jr. AEDC Aug. 1975 41 p refs
(ARO Proj. PF208; ARO Proj. PF408)
(AD-A013728; ARO-PWT-TR-75-36; AEDC-TR-75-88) Avail: NTIS CSCL 20/1

The aerodynamic noise emitted by perforated walls in transonic wind tunnels has been under study for several years at AEDC. This report presents a summary of recent experimental tests to suppress perforated wall noise in transonic test sections. The mechanism of noise generation from perforated walls having 60-deg inclined holes is the edgetone phenomenon where the shear layer over each hole interacts with the trailing edge to produce intense tones at discrete frequencies. Noise reduction was achieved with several modified wall samples in the 6-in. tunnel at resonance conditions. GRA

# 72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

**N76-14904** Catholic Univ. of America, Washington, D.C.
**DEPOLARIZED RAYLEIGH SCATTERING IN SIMPLE FLUIDS Ph.D. Thesis**
Sung Chung An 1975 130 p
Avail: Univ. Microfilms Order No. 75-25363

The spectrum and intensity of depolarized Rayleigh scattering from atomic fluids (Ar and Kr) and high symmetric molecular fluids (CH4 and CF4) was studied at temperatures in the range 90 to 200 K at densities ranging from below the critical density to those characteristic of the triple point. The spectra were obtained for frequencies ranging from within 2/cm of the incident laser frequency to roughly 150/cm. The spectra were characterized as the sum of a relatively narrow Lorentzian component and a broad background line. Both the intensity and the halfwidth of the Lorentzian component were observed to decrease with increasing density. These results were rationalized by assuming that the scattering arises from dipoles induced during the interaction of neighboring molecules. The variation of the intensity with density was compared with the prediction of a microscopic model which relates the scattering to the anisotropy in the local structure around a given molecule. Dissert. Abstr.

**N76-14905** Columbia Univ., New York.
**POSITRON INTERACTIONS WITH VACANCIES AND DISLOCATIONS Ph.D. Thesis**
John Paul Wallace 1975 117 p
Avail: Univ. Microfilms Order No. 75-27472

It was found analytically that, except at very high vacancy concentrations, it is mainly the nonthermal positrons with variable velocity that are being trapped at sampling vacancies. The implication of this finding is that the positron annihilation technique may not be suitable for the determination of the energy of vacancy formation. It was found that there is long lifetime component tau sub 2 in deformed metals and engineering alloys which is found to increase perceptibly as the extent of plastic deformation increases. The positrons can distinguish between cold rolled and recovered aluminum, and virgin and crept super-alloys.
Dissert. Abstr.

**N76-14906** Saint Louis Univ., Mo.
**THEORETICAL CALCULATIONS OF MOLECULAR COLLISION PHENOMENA IN NON-POLAR GASES Ph.D. Thesis**
David William Nehrkorn 1974 103 p
Avail: Univ. Microfilms Order No. 75-26296

When considering the theoretical calculation of the transport properties of a gas, it is necessary to evaluate the angle of deflection in a bimolecular collision. From this fundamental property of a collision, it is possible to calculate the following macroscopic observables: self-diffusion coefficient, thermal conductivity, the distance of closest approach to two molecules which collide with zero initial relative kinetic energy, the conditions for orbiting, and epsilon/k, where epsilon is the maximum energy of attraction of the two molecules, and k is the Boltzmann constant. From a knowledge of epsilon/k, and the intermolecular potential function, it is possible to calculate the second virial coefficients for the gases under study. These calculated values can then be compared with experimentally determined values to check the

validity of the theoretical model. The gases considered in this dissertation are the noble gases with the exception of Radon. The numerical calculations included are augmented by numerous computer prepared graphs, several representative computer programs are presented. Dissert. Abstr.

**N76-14907#** Yale Univ., New Haven, Conn. Dept. of Physics.
**THEORY OF ATOMIC STRUCTURE, ELECTRON-ATOM AND ATOM-ATOM SCATTERING WITH APPLICATION TO COMMUNICATIONS AND LASERS Final Report, 1 Jun. 1970 - 31 Mar. 1975**
Vernon W. Hughes and Charles M. Sommerfield 1975 17 p refs
(Contract F44620-70-C-0091; AF Proj. 9761)
(AD-A013819; AFOSR-75-1168TR) Avail: NTIS CSCL 07/4

Very briefly described is research conducted on the following topics: Fine structure and Zeeman effect of helium; Zeeman and Stark effect of positronium; hyperfine structure of the muonic helium atom; Lamb shifts of hydrogenic ions of high Z; nonadiabatic effects in slow atomic collisions; quenching of the metastable 2S state of muonic hydrogen and the muonic helium ion; two photon absorption; and quantization of electrodynamics hyperboloids and generalization of the effective action for electrodynamics. GRA

**N76-14908#** Science Applications, Inc., Ann Arbor, Mich.
**HIGH RESOLUTION SPECTRAL SURVEY OF MOLECULAR ABSORPTION IN THE DF LASER REGION: MEASUREMENTS AND CALCULATIONS Interim Technical Report, 1 Aug. 1974 - 1 Feb. 1975**
Douglas Woods, Robert Meredith, Frederick Smith, and Thomas Tuer Jul. 1975 102 p refs
(Contract F30602-75-C-0028; ARPA Order 1279; AF Proj. 1279)
(AD-A013736; RADC-TR-75-180) Avail: NTIS CSCL 07/4

The investigation has a threefold objective: (1) Provide the data base from which predictive laser propagation modeling parameters can be extracted; (2) identify and quantify inadequacies in the current modeling parameters; and (3) determine the sensitivity of altitude and meteorological scaling to the modeling parameters. All three of these objectives are addressed in this interim report. The impact of predictive analysis on temperature and altitude scaling is discussed. The propagation of the P(1)(9) and P(3)(8) DF lines are predicted as specific examples of the nature of the altitude and temperature scaling problem. Also studied were spectral measurements on HDO, CH4 and N2O. Line absorption are presented and comparisons are made with current predictive calculations (i.e., synthetic spectra). A specific application to P(1)(7) propagation is discussed in the context of the HDO measurements. GRA

# 73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

**N76-14909** Maryland Univ., College Park.
**STUDY OF ELECTRON RING FORMATION AND EQUILIBRIUM Ph.D. Thesis**
Juris George Kalnins 1975 125 p
Avail: Univ. Microfilms Order No. 75-28757

The single-particle behavior of electrons in the ERA field geometry was studied in terms of the compressed ring axial velocity and orbit off-centering. Analytic equations were developed to include the effects of the cusped magnetic field, a centering coil, as well as an adiabatic compression field. The results are compared with experiment and the results of numerical integration. The axial deceleration of a thin electron ring by a resistive-wire loop was studied both analytically and numerically. For axially-extended beams, numerical simulation methods were used to show the feasibility of trapping part of the beam to form an electron ring, using a mirror-field geometry and resistive-wire loops. The equations relating the equilibrium electron ring major radius, kinetic energy and rotation frequency to the parameters at injection are derived in a Vlasov and fluid description of the ring. The equations are solved using the calculated bias field of the ring for two ring formation schemes of interest. A two-fluid model was used to calculate the electron-ion radial separation in the ring as well as the bias field term for the electron-ion dipole resonance. Dissert. Abstr.

**N76-14910*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**NUCLEON AND HEAVY-ION TOTAL AND ABSORPTION CROSS SECTION FOR SELECTED NUCLEI**
John W. Wilson and Christopher M. Costner (Old Dominion Univ., Norfolk, Va.) Washington Dec. 1975 77 p refs
(NASA-TN-D-8107; L-10547) Avail: NTIS HC $5.00 CSCL 20H

Approximate solutions of the coupled-channel equations for high-energy composite particle scattering are obtained and are applied to the nuclear scattering problem. Relationships between several approximation procedures are established and discussed. The eikonal formalism is used with a small-angle approximation to calculate the coherent elastic scattered amplitude from which total and absorption cross sections are derived. Detailed comparisons with nucleon-nucleus experiments show agreement within 5 percent except at lower energies where the eikonal approximation is of questionable accuracy. Even at these lower energies, agreement is within 15 percent. Tables of cross sections required for cosmic heavy-ion transport and shielding studies are presented. Author

# 74 OPTICS

Includes light phenomena.

**N76-14911** Ohio State Univ., Columbus.
**A METHOD FOR THE SOLUTION OF THE EQUATION OF RADIATIVE TRANSFER FOR RESONANCE LINES Ph.D. Thesis**
David Graves Price 1975 104 p
Avail: Univ. Microfilms Order No. 75-26644

A mathematical procedure is developed for solving the integrodifferential equation of radiative transfer for the case of resonance lines in scattering media of large optical depth. The approach used is a variation of the fundamental matrix method of direct integration of the line profile across the medium; the profile is represented by a system of linearized equations, each corresponding to a given frequency and direction. The variation consists of employing a suitable approximation for each equation whose corresponding optical depth at line center becomes greater than a given constant cutoff value, as the integration across the medium proceeds. The integrated system of equations is then solved with the boundary conditions to obtain the resulting emitted and backscattered flux profiles. Dissert. Abstr.

**N76-14912** Rochester Univ., N.Y.
**SPECIFICATION OF COLOR IMAGE QUALITY Ph.D. Thesis**
Edward Maurice Granger 1975 236 p
Avail: Univ. Microfilms Order No. 75-22742

Measurement and specification of color image quality are considered. This included the subclass of black-and-white images. A definition of an Image Quality Merit Function (IQMF) was obtained which gives consistent evaluations of the subjective quality of color images. The IQMF was developed by modeling the spatial and spectral properties of the visual system. The consideration of the visual system properties in the calculation of the quality merit has produced a practical image quality criterion which is easily calculated and directly measurable and which yields consistent predictions of system performance. The correlation between the predicted and measured subjective quality ratings exceeded 0.98 for all the conditions used in the study. Dissert. Abstr.

**N76-14913#** Research Inst. of National Defence, Stockholm (Sweden).

**ATMOSPHERIC ATTENUATION OF A LIGHT BEAM DUE TO SCATTERING AND ABSORPTION**
Staffan Hoeijer Mar. 1974 105 p refs
(FOA-2-C-2659-E1-E2-E3-E4) Avail: NTIS HC $5.50

A basis is developed for future experiments involving measurements of the attenuation of a light beam propagating in the atmosphere. The main purpose is to discuss how the influence of aerosols and hydrometeors can be isolated from the measured attenuation values. The quantity of main interest is the particle extinction coefficient which is a function of the wavelength of the light. This coefficient is the basic quantity for further calculations of the properties of the particles, eg. for determining their size distribution. Some of the special problems involved when using a bidirectional path are discussed, as this is the experimental configuration that is being used. Author

**N76-14914#** Research Inst. of National Defence, Stockholm (Sweden).
**OPTICS: A TECHNICAL SURVEY. BASIS FOR TP74 [TEKNISK OEVERSIKT ROERANDE OPTIK. UNDERLAG FOER TP74]**
Erik Daniels, Daniel Glansholm, Britt Hartmann, Lennart Holm, Bengt Kloeman, Per Lindberg, Barbro Lindeborg, Sten Nordlander, Ove Steinvall, Gunnar Tonnquist et al Apr. 1974 84 p In SWEDISH
(FOA-2-C-2663-E8) Avail: NTIS HC $5.00

The report is the basis for a discussion on Optics published in Teknisk Progress 1974 (TP74) under the title "Basic Techniques for reconnaissance, communication, guidance and countermeasures". The principle aim of the report is to collect together and preserve technical data and other information which formed the basis of Optics - TP74. The range covered includes optical environment, IR technique, photoamplifiers and low light TV, lasers, modulation and deflection; optical methods for reading signals, and photography. Author

**N76-14915*#** College of the Holy Cross, Worcester, Mass.
**REPLICA GRATING STUDY Final Report, 1 Jun. 1966 - 25 Apr. 1975**
Roy C. Gunter, Jr. 25 Apr. 1975 21 p
(Grant NGR-22-091-002)
(NASA-CR-144702) Avail: NTIS HC $3.50 CSCL 20F

Methods are outlined which were used to test the response of replica diffraction gratings to a space environment, specifically the response of the replica gratings to thermal-vacuum and electron irradiation stress. It is concluded that there probably is some degradation to thermal stress, but that there is probably no significant degradation due to a vacuum environment. It is further concluded that the degradation of performance of replica gratings because of electron irradiation is due to the interaction of the electrons and the replica grating substrate and not to the replication material itself. Replica and original gratings on the same substrate material should thus respond to particle irradiation in the same manner. A study is presented on the variation of refraction index of a space-related material, Nd:CaF2, with wavelength, percent neodymium doping, and temperature. Author

**N76-14916*#** Hughes Research Labs., Malibu, Calif.
**OPTICAL-TO-OPTICAL INTERFACE DEVICE Final Technical Report, 10 Feb. 1973 - 8 Sep. 1974**
A. Jacobson, W. P. Bleha, Leroy Miller, J. Grinberg, L. Fraas, and D. Margerum Apr. 1975 130 p refs
(Contract NAS5-23192)
(NASA-CR-144700) Avail: NTIS HC $6.00 CSCL 20F

An investigation was conducted to develop an optical-to-optical interface device capable of performing real-time incoherent-to-incoherent optical image conversion. The photoactivated liquid crystal light valve developed earlier represented a prototype liquid crystal light valve device capable of performing these functions. A device was developed which had high performance and extended lifetime. Author

**N76-14917*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**EFFECTS OF 1- AND 2-MeV ELECTRONS ON PHOTOMULTIPLIER TUBES**
Marvin E. Beatty, III, William J. Debnam, Jr., and Barry D. Meredith Washington Jan. 1976 28 p refs
(NASA-TN-D-8125; L-10347) Avail: NTIS HC $4.00 CSCL 20F

Various types of photomultiplier tubes useful for space applications were irradiated with 1- and 2-MeV electrons at Van Allen radiation belt fluxes of 100,000 to 10 millions electrons/sq cm-sec. The increase in the dark current due to electron irradiation was observed at various bias voltages under worst-case conditions (no shielding). Results were presented in the form of dark current plotted against electron flux. All the tubes tested showed extremely large increases in dark current. Tube types 541A, 6217, 6199, and 6903 exhibited the largest increases under irradiation, whereas type 1P22 was affected the least. All the damage observed was transient. The luminescence produced in the optical window probably accounts for a large part of the dark-current increases, but there were some effects possibly due to direct irradiation of the photocathode and dynode chain. Author

**N76-14918#** Rockwell International Corp., Anaheim, Calif. Electronics Research Div.
**INVESTIGATION OF SURFACE OPTICAL WAVES FOR OPTICAL SIGNAL PROCESSING Final Technical Report, 1 Jun. 1974 - 31 May 1975**
J. D. McMullen and D. L. Mills (Calif. Univ., Irvine) 31 May 1975 111 p refs
(Contract DAHC04-74-C-0024)
(AD-A013494; C74-930.4/501; ARO-12120.2-P) Avail: NTIS CSCL 20/6

Properties of surface polaritons are investigated which may be applied to the processing of CO2 laser radar signals. Experimental measurement has been made of the dispersion and propagation lengths of surface plasmons and surface phonon-polaritons at 10.6 micrometers. Analytical studies were made of scattering of surface polaritons and Rayleigh waves, surface polaritons propagating on a periodically rough surface, dispersion characteristics of surface polaritons in layered structures, coupling of an optical beam by the prism and grating methods and electro-optic phase modulation of a surface optical wave. GRA

**N76-14919#** Tennessee Univ., Knoxville. Ultrasonics Lab.
**FRAUNHOFER DIFFRACTION OF LIGHT AND OF ULTRASONIC WAVES BY GRATINGS HAVING MULTIPLE PERIODICITIES**
Michael A. Torbett Jun. 1975 86 p refs
(Contract N00014-71-A-0121-0001; NR Proj. 384-306)
(AD-A014089; TR-12) Avail: NTIS CSCL 20/6

The theory of Fraunhofer diffraction of light by coherently illuminated amplitude transmission gratings having an arbitrary number of periodicities has been developed by Fourier transform techniques. This mathematical description has been specialized for the case of a grating having a double periodicity. The resulting expression has been tested experimentally. In addition, the case of the singly-periodic grating was also considered. In each case agreement between theory and experiment was found to be reasonable in the lower diffraction orders. In the higher diffraction orders, the agreement was not as good. An ultrasonic schlieren apparatus made it possible to model the optical experiment with an analogous acoustical one. Photographs of the diffraction of ultrasonic waves by gratings having single and double periodicities were made. Qualitative comparison between the optical and acoustical configurations is made. GRA

**N76-14920#** Metavac, Inc., Flushing, N.Y.
**PRODUCTION ENGINEERING MEASURES INFRARED FILTER FOR 1kW SEARCHLIGHT AN/VSS-3A Quarterly Report, 1 Mar. - 31 May 1975**
John Monte 10 Jul. 1975 23 p
(Contract DAAB07-74-C-0379)
(AD-A013585; QR-4) Avail: NTIS CSCL 20/6

Combining the three pre-engineering filters made and factory tested during the last quarter with three additional filter assemblies, a group of six filter assemblies was gathered and submitted to factory level tests. All filters were found to be satisfactory in their spectral transmission characteristics, their adhesion, and resistance to storage for periods of twenty-four hours at very high relative humidity. Three filters were selected and brought to Fort Belvoir, Virginia where a satisfactory night range is

available for testing of visual security when mounted in a searchlight. Two filters were tested for total periods of about eighty hours, and one of them was dissembled and examined closely for signs or evidence of sealant or filter coating deterioration. It was judged that five filters could be selected and submitted to the Government as Engineering Samples. GRA

**N76-14921#** Intelcom Rad Tech, San Diego, Calif.
**TRANSIENT RADIATION EFFECTS IN OPTICAL MATERIALS Final Report, Feb. 1974 - 30 Apr. 1975**
Michael J. Treadaway, Burr C. Passenheim, and Bob D. Kitterer 29 Apr. 1975 154 p refs
(Contract F04701-74-C-0237; DNA Proj. NWED-QAXT-A026) (AD-A013922; Intel-RT-6068-044; SAMSO-TR-75-174) Avail: NTIS CSCL 20/6

The results of an extensive investigation of the optical response of thirteen common optical materials to 2.5-MeV electron irradiation is reported. Radiation-induced absorption and absolute radioluminescence yields were measured in the wavelength range 0.14 to 0.9 micrometers for dose rates between 0.05 to 0.00005 rad/sec at doses from 0.0023 to 0.00000045 rads. Sapphire, fused and crystalline quartz and ten Schott optical glasses were investigated. Determinations were made of (a) the absolute radioluminescence yield, (b) the dose rate dependence yield, (c) the spectral and temporal distribution of the radioluminescence and induced absorption, (d) the growth curve of the induced absorption versus total dose, (e) the dose-rate dependence of the absorption, and (f) the bleaching of the absorption after irradiation. In addition, where available, samples from different melts were investigated to determine the variation in the above effects with manufacturing variation. GRA

**N76-14922#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**RADIATION EFFECTS ON FIBER OPTICS Final Physical Sciences Research Papers**
James A. Wall and John F. Bryant 2 Apr. 1975 56 p refs (ILIR Proj. 3E-01)
(AD-A013786; AFCRL-PSRP-627; AFCRL-TR-75-0190) Avail: NTIS CSCL 20/6

Samples representative of most of the optical fibers presently available in lengths of 10 m or more were tested for their responses to energetic radiation. Glass fibers doped with three different levels of cesium were also prepared and tested. Permanent and transient X-radiation effects tests were performed. Neutron effects tests were performed. All of the fibers tested showed decreases in transmission when exposed to radiation. All of the fibers emitted fluorescent light pulses when exposed to intense X-ray pulses. GRA

**N76-14923#** Aerospace Corp., El Segundo, Calif. Lab. Operations.
**BAND MODEL FORMULATION FOR INHOMOGENEOUS OPTICAL PATHS Interim Report**
Stephen J. Young 31 Jul. 1975 15 p refs
(Contract F04701-75-C-0076; DARPA Order 2843)
(AD-A013766; TR-0076(6970)-3-Add; SAMSO-TR-75-210) Avail: NTIS CSCL 20/6

The statistical band model formulation for highly inhomogeneous optical paths presented in a previous paper is extended to the case where the strengths of lines in Delta nu are distributed according to a modified inverse probability function. GRA

**N76-14924#** National Bureau of Standards, Washington, D.C. Heat Div.
**OPTICAL RADIATION MEASUREMENTS: THE NBS 20-, 60-, AND 85-DEG SPECULAR GLOSS SCALES Final Report**
Jack J. Hsia Jul. 1975 35 p refs
(COM-75-11111/2; NBS-TN-594-10) Avail: NTIS HC $4.00 CSCL 14B

One of many programs is examined of the spectrophotometry group of the Optical Radiation Section of NBS directed toward improving the accuracy and assurance of spectrophotometric measurements made throughout the scientific and industrial community. The specular gloss scales are established through a unique technique employing polarized light flux both parallel and perpendicular to the plane of incidence. General calibration equations are derived. NBS instrumentation and measurement procedures are described. Instrument calibration and error analyses are performed. Some of the analyses can also be applied to reflectance measurements in general. GRA

**N76-14925#** Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
**VIRTUAL IMAGE DISPLAY TEST RESULTS Final Report, May 1974 - Apr. 1975**
James C. Byrd Apr. 1975 84 p
(AD-A013724; ASD-TR-75-20) Avail: NTIS CSCL 09/5

The report consists of a summary of the results obtained in tests performed on the Virtual Image Display System. A detailed list of data obtained from the experiment is included as an Appendix. The data indicates that a Virtual Image lens can improve performance of airborne display systems significantly. GRA

# 75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

**N76-14926** Michigan Univ., Ann Arbor.
**EXCITATION AND PROPAGATION OF LOWER-HYBRID WAVES IN AN INHOMOGENEOUS, BOUNDED PLASMA Ph.D. Thesis**
Patrick Leslie Colestock 1975 235 p
Avail: Univ. Microfilms Order No. 75-29192

The boundary-value problem for the electrostatic potential in a cold, inhomogeneous plasma is solved numerically as a superposition of the radial eigenmodes excited by a finite-length source. Radial eigenmodes were found numerically by an algorithm which includes the case where the lower-hybrid resonance layer occurs in the plasma. The effect of collisions and plasma inhomogeneity on the eigenmodes was investigated. The eigenmode superposition is carried out for a split-cylinder source driven either in phase or out of phase. The plasma response was found to be composed of so-called resonance-cone surfaces along which the electrostatic potential is a maximum. At frequencies just above the maximum lower-hybrid frequency in the column, the resonance-cone surfaces are shown to extend over large axial distances from the sources before reflecting from the column axis. At frequencies below the maximum lower-hybrid frequency, the resonance-cone surfaces become asymptotic to the lower-hybrid resonance layer. It is shown that collisional damping tends to dissolve the resonance-cone structure leaving the lowest-order eigenmode excited by the source. Dissert. Abstr.

**N76-14927** Kansas Univ., Lawrence.
**NUMERICAL SIMULATION OF THE INTERACTION OF CHARGED PARTICLES WITH OBLIQUE MAGNETOHYDRODYNAMIC SHOCKS Ph.D. Thesis**
Gloria Linling Chen 1975 131 p
Avail: Univ. Microfilms Order No. 75-26370

The motion of high energy charged particles in ideal oblique MHD shocks, characteristic of the interplanetary medium, was studied extensively. The shock is treated as a plane surface across which the tangential component of magnetic field changes discontinuously. The orbits of charged particles can be solved exactly from Lorentz force equation and initial conditions of particles in each region, pre- and post-shock, separately. The essential precedure is to determine the crossings; that was achieved by solving numerically for the times when the particles meets the shock. The position and velocity vectors are continuous across the shock. An ensemble of 1972 monoenergetic particles distributed isotropically in the shock frame are chosen to obtain collective results. Dissert. Abstr.

**N76-14928** Florida State Univ., Tallahassee.
**CHARACTERIZATION OF SEVERAL dc ARC PLASMA JET DEVICES AS EXCITATION SOURCES FOR EMISSION SPECTROMETRY Ph.D. Thesis**

William Edward Rippetoe 1975 146 p
Avail: Univ. Microfilms Order No. 75-26812

The first device described utilizes the introduction of potassium chloride to reduce background emission from the plume and to improve aerosol introduction into the plasma. The dependence of excitation temperature in the plume on the concentration of potassium chloride sprayed, on the arc current, and on the vertical position is reported. Detection limits are reported for seven elements (Al, Cd, Cr, Fe, Pb, V, W). For a single set of operating conditions, the detection limits are as good as or better than the best reported flame emission values. The second device investigated utilizes a rotating permanent magnet to induce rotation of the arc discharge between two concentric ring electrodes. Rotation of the discharge is found to increase electrode life and improve short and long term stability. The third device investigated incorporates a durable electrode system with arc rotation induced by a tangential gas stream. Good short and long term stability is achieved. Dissert. Abstr.

**N76-14929** Cornell Univ., Ithaca, N.Y.
**WHISTLER WAVE EXPERIMENTS IN A BOUND PLASMA Ph.D. Thesis**
Milton David Johnson 1975 165 p
Avail: Univ. Microfilms Order No. 75-27031

The propagation of an electromagnetic Whistler wave and its interaction with an electron beam was studied. This required the development of a suitable plasma, the study of wave propagation in a bounded laboratory plasma and the development of an electron beam. The quiescent argon plasma had an electron density typically a few times ten to the twelth power per cubic centimeter with an electron temperature of about 3 ev. The plasma was produced with 1 Kw at 2.56 Hz in a slow-wave structure in a one kilo-gauss 2:1 magnetic mirror field. Small loop antennas were used to launch and receive electromagnetic Whistler waves. The wave dispersion was measured and found to agree with the infinite cold plasma theory, although other modes were also present. A simple Landau interaction between the bounded Whistler wave and the beam was studied. Good agreement with theory was obtained when realistic beam distribution functions were used. Dissert. Abstr.

**N76-14930** Washington Univ., Seattle.
**THOMPSON SCATTERING MEASUREMENTS IN A LASER HEATED THETA-PINCH Ph.D. Thesis**
Jay S. Pearlman 1974 128 p
Avail: Univ. Microfilms Order No. 75-28414

Measurements of the interaction of CO2 laser radiation with a theta pinch plasma were made using laser scattering as a diagnostic technique. Laser scattering is particularly suited for these types of measurements because the small observation volume with respect to the size of the plasma reduces problems of plasma temperature and density gradients. In addition the technique does not require the existence of local thermodynamic equilibrium for validity. Laser scattering theory is presented including a discussion of magnetic, collisional, quantum mechanical and relativistic effects. Design and construction of the scattering experiment are described along with measurements of the ruby and CO2 lasers. The plasma was heated axially with a TEA CO2 pin laser. A density minimum in the core of the plasma which was observed by image converter photographs resulted in light piping of the CO2 laser beam. The scattering measurements show the time evolution of the laser heated plasma during and after heating by the 'spike' of the CO2 laser. Dissert. Abstr.

**N76-14931*** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
**TWO STAGE LIGHT GAS-PLASMA PROJECTILE ACCELERATOR Patent**
Edward L. Shriver, David W. Jex, inventors (to NASA), and Edward B. Igenbergs (NAS-NRC) Issued 4 Nov. 1975 10 p Filed 29 Jan. 1974 Supersedes N74-18891 (11 - 10, p 1148)
(NASA-Case-MFS-22287-1; US-Patent-3,916,761; US-Patent-Appl-SN-438-147; US-Patent-Class-89-8; US-Patent-Class-73-12; US-Patent-Class-315-111.6) Avail: US Patent Office CSCL 20I

A device for accelerating a projectile to extremely high velocities is described. The device includes a light gas accelerator to impart an initial high velocity to the projectile and a plasma accelerator and compressor receiving the moving projectile and accelerating it to higher velocities. A capacitor bank is discharged into a plasma generator in timed relationship to the position of the projectile so that the moving plasma drags the projectile along with it. Projectile velocities in the order of 20 kilometers per second, the average meteoroid velocity, can be attained. The accelerator finds particular utility in the field of meteoroid simulation. Official Gazette of the U.S. Patent Office

**N76-14932*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**DENSE PLASMA FOCUS PRODUCTION IN A HYPOCYCLOIDAL PINCH**
Ja H. Lee (Vanderbilt Univ., Nashville, Tenn.), Donald R. McFarland, and Frank Hohl Washington Dec. 1975 42 p refs
(NASA-TN-D-8116; L-10549) Avail: NTIS HC $4.00 CSCL 20I

A type of high-power pinch apparatus consisting of disk electrodes was developed, and diagnostic measurements to study its mechanism of dense plasma production were made. The collapse fronts of the current sheets are well organized, and dense plasma focuses are produced on the axis with radial stability in excess of 5 microns. A plasma density greater than 10 to the 18th power/cubic cm was determined with Stark broadening and CO2 laser absorption. A plasma temperature of approximately 1 keV was measured with differential transmission of soft X-rays through thin foils. Essentially complete absorption of a high-energy CO2 laser beam was observed. The advantages of this apparatus over the coaxial plasma focus are in (1) the plasma volume, (2) the stability, (3) the containment time, (4) the easy access to additional heating by laser or electron beams, and (5) the possibility of scaling up to a multiple array for high-power operation.
Author

**N76-14933*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**SUMMA HOT-ION PLASMA HEATING RESEARCH AT NASA LEWIS RESEARCH CENTER**
J. J. Reinmann, R. W. Patch, and M. R. Lauver 21 Nov. 1975 14 p refs Presented at Sixth Symp. on Engineering Probl. of Fusion Res., San Diego, Calif., 18-21 Nov. 1975; sponsored by Am. Nucl. Soc.
(NASA-TM-X-71840) Avail: NTIS HC $3.50 CSCL 20I

The SUMMA superconducting magnetic mirror facility and the associated hot-ion plasma research were described. SUMMA is characterized by intense magnetic fields and a large-diameter working bore (41 cm diameter) with room-temperature access. The goal of the plasma research program is to produce steady-state plasmas of fusion reactor densities and temperatures (but not confinement times). The program includes electrode development to produce a hot, dense, large-volume, steady-state plasma and diagnostics development to document the plasma properties. SUMMA and its hot-ion plasma are ideally suited to develop advanced plasma diagnostics methods. Two such methods whose requirements are well matched to SUMMA are: (1) heavy ion beam probing to measure plasma space potential; and (2) submillimeter wavelength laser Thomson scattering to measure local ion temperature. Author

**N76-14934*#** Scientific Translation Service, Santa Barbara, Calif.
**GAS TEMPERATURE IN A PLASMA PRODUCED BY A CARBON MONOXIDE LASER**
V. S. Dorosh, L. F. Dobro, V. N. Ivanov, E. N. Lotkova, and V. V. Pisarenko Washington NASA Dec. 1975 11 p refs Transl. into ENGLISH from Kvantovaya Elektron. (Moscow), v. 2, May 1975 p 1030-1034
(Contract NASw-2791)
(NASA-TT-F-16815) Avail: NTIS HC $3.50 CSCL 20I

Results were reported for thermocouple, interferometric, and spectroscopic measurements of the gas temperature in a plasma produced at different values of the gas pressure, discharge current, and input power by a carbon monoxide laser operating at room temperature. The laser utilized a mixture of carbon monoxide, nitrogen, helium, xenon, and oxygen in the proportion 1:5:24:1:0:04. The experimental results were compared with those obtained from the solution of the thermal-balance equation, and an accuracy of 5% to 8% was noted. Author

**N76-14935#** Naval Research Lab., Washington, D.C.
**NUMERICAL STUDY OF THE DISSIPATIVE TRAPPED-ELECTRON INSTABILITY IN TOKAMAKS**
K. R. Chu and Wallace M. Manheimer Jul. 1975 13 p refs
(NRL Proj. H02-37)
(AD-A013990; NRL-MR-3080) Avail: NTIS CSCL 20/9

The dispersion relation for the dissipative trapped-electron mode including the effects of magnetic shear, finite ion-Larmor radius, banana-plateau velocity space separation, ion temperature gradient, and ion-ion collisions was used to examine the stability property of recent Tokamak experiments. The heat conduction coefficient predicts losses negligible compared to those observed experimentally. Author (GRA)

**N76-14936#** Aerospace Corp., El Segundo, Calif. Space Physics Lab.
**RESONANCE BROADENING IN A TURBULENT PLASMA Interim Report**
Michael Schulz 14 Jul. 1975 15 p refs
(Contract F04701-75-C-0076)
(AD-A013693; TR-0076(6260-20)-5; SAMSO-TR-75-185) Avail: NTIS CSCL 20/9

Resonance between a wave and a particle in a uniform plasma can be defined by a general formula. In a turbulent plasma, however, this resonance defined is further broadened by virtue of particle diffusion in phase space. The purpose of the present note is to describe an intuitive classroom-level derivation, by means of which one could have estimated the width of the resonance without invoking a formal derivation. The intuitive approach makes instructive use of (a) the classical uncertainty principle and (b) the random-walk interpretation of diffusion, in placing convergent lower and upper bounds on the time interval during which a wave and a particle can interact coherently. The optimal interaction time thus obtained corresponds to the minimum bandwidth that can be assigned to the resonance. GRA

**N76-14937#** Colorado State Univ., Fort Collins. Dept of Electrical Engineering.
**ELECTROSTATIC DIAGNOSTICS OF HIGH-PRESSURE PLASMA**
Robert C. Hazelton, R. J. Churchill, and P. W. Chan Dec. 1974 59 p refs
(Contract F19628-70-C-0035; AF Proj. 7260; AF Proj. 6813)
(AD-A013938; AFCRL-TR-74-0639; SR-13) Avail: NTIS CSCL 20/9

Considerable interest has been generated in the measurements of reentry plasma parameters because of the communication blackout produced by the plasma surrounding a reentry vehicle. An electrostatic probe is well suited for such diagnostics because of its simplicity, ruggedness, spatial resolution, and ease of interpretation of measurements. The present work is concerned with a plane electrostatic probe diagnosis of a flowing, argon jet plasma with an electron temperature ranging from about 6000 - 8000K and an electron density in the range (10 to the 13th power 10 to the 15th power/cc). The present work also deals with the analysis of two possible theories to describe the operation of the probe: a free fall theory and a continuum theory. Analysis of the experimental results indicates that the continuum theory for a plane electrostatic probe as developed by Su and Kiel (1966) is valid in the plasma tested. GRA

**N76-14938#** Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
**NON-EQUILIBRIUM IN A FREE-BURNING ARGON ARC PLASMA**
M. Niimura, P. W. Chan, and R. J. Churchill Dec. 1974 52 p refs
(Contract F19628-70-C-0035; AF Proj. 7260; AF Proj. 6813)
(AD-A013936; AFCRL-TR-74-0638; SR-12) Avail: NTIS CSCL 20/9

The axial distributions of the electron temperature and number density in a free-burning argon arc plasma at atmospheric pressure have been measured experimentally using a Thomson scattering technique. The axial temperature distribution has also been measured spectroscopically by the relative line intensity method. The results are presented in terms of the degree of non-equilibrium distribution shifted from the calculated Saha equilibrium temperature and the heavy particle temperature at different spatial positions along the axis of the arc. It is shown that the temperatures as measured by light scattering are different from those measured by relative line intensity ratio method. The difference is ascribed to the nonequilibrium of the arc as well as to the special geometry of the arc cathode. GRA

**N76-14939#** Naval Research Lab., Washington, D.C.
**A TIME RESOLVED PINHOLE CAMERA FOR OBSERVATION OF NANOSECOND DURATION XUV PLASMA EMISSION**
David J. Johnson, Stavros J. Stephanakis, and John R. Boller Jun. 1975 13 p refs
(DNA Proj. NWED-QAXL-A104; NRL Proj. H02-26A)
(AD-A013637; NRL-MR-3065) Avail: NTIS CSCL 20/9

A vacuum diode with rear mounted Pilot-B scintillator has been coupled with a conventional evacuated pinhole camera. The cathode of the diode is fabricated from 2 micrometer thick polycarbonate (Kimfol) with a 200 A aluminum layer on the rear surface. Incident photons with energies above the carbon K edge (284 eV) are highly absorbed in the polycarbonate but photons with energies below the K edge are absorbed in the aluminum and produce photoelectrons. This yields a photoelectron sensitivity which is peaked at approximately 275 eV. The photoelectrons are accelerated by a 10 kV cathode potential to an aluminum anode coating on the scintillator and scintillation photons are observed with an image converter camera. Streak photographs of exploded-wire XUV radiation taken with this system are presented. GRA

**N76-14940#** Naval Research Lab., Washington, D.C.
**ACCELERATORS FOR THE FUSION PROGRAM Interim Report**
R. N. Sudan Jul. 1975 28 p refs
(NRL Proj. H02-27B)
(AD-A013638; NRL-MR-3073) Avail: NTIS CSCL 20/9

The role of accelerated particle beams in the controlled fusion program is reviewed. A brief discussion of neutral beam heating of Tokamak plasma is followed by an account of the physical processes underlying the anomalous stopping length of high power electron beams in plasmas of different density regimes. Applications of such E-beam heating to pulsed fusion systems is noted. Finally the recent success of high-power ion accelerators leads to serious consideration of their use in generating field reversed proton-layers. The magnetic compression of P-layers to reach energy and power density required for Lawson breakeven condition is examined. GRA

**N76-14941#** Rensselaer Research Corp., Troy, N.Y. Plasma Dynamics Lab.
**CURRENT DENSITY AND SPACE POTENTIAL IN PLASMAS Interim Report**
Robert L. Hickok and William C. Jennings Jun. 1975 12 p refs
(Grant AF-AFOSR-2638-74; AF Proj. 9751)
(AD-A013840; RPDL-75-6; AFOSR-75-1166TR) Avail: NTIS CSCL 20/9

A model that describes the operation of a magnetically confined, hollow cathode arc discharge has been developed. This model will be used to design a high current arc facility suitable for the development of plasma current density techniques using an ion beam probe. Improved electrostatic energy analyzers for use with ion beam probing have been developed. The new analyzers provide better frequency response and permit the evaluation of the position and velocity displacement produced by the plasma current. GRA

# 76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

**N76-14942** Georgia Inst. of Tech., Atlanta.
**KINETIC STUDY OF CRYSTAL GROWTH FROM SUPERSATURATED DROPLETS Ph.D. Thesis**
Fu-Chu Wen 1975 108 p

Avail: Univ. Microfilms Order No. 75-26218

Nucleation processes are described mathematically by the Zeldovich-Frenkel equation. Solutions of the equation lead to two relaxation times; the relaxation time to approach the steady-state cluster distribution and the relaxation time to achieve the occurrence of the critical cluster. Theoretical investigation indicates that, for nucleation from aqueous solutions the induction time of homogeneous nucleation is governed by the latter, while the former plays an important role in heterogeneous nucleation. Relationships between relaxation time and the conditions of supersaturation were derived for several possible situations. Homogeneous nucleation of crystals from aqueous sodium chloride solutions was studied with a droplet technique. Droplets of very small size were dispersed as aerosols instead of into oil. The relaxation time was determined with a light extinction method. Using a simple relationship between the relaxation time and the homogeneous nucleation rate, the kinetic constant and the crystal-solution interfacial free energy were found. Dissert. Abstr.

**N76-14943#** Texas Univ., Austin. Dept. of Physics.
**ON THE IMPORTANCE OF sp-ELECTRONS IN THE SURFACE RELAXATION OF d-BAND METALS**
G. Alldredge and S. K. S. Ma 13 Jan. 1975 4 p refs Submitted for publication
(Grant AF-AFOSR-1973-71)
(AD-A013140/9; AFOSR-75-1042TR) Avail: NTIS HC $3.50 CSCL 20/2

Arguments are presented to show that the self-consistent smoothing of the mobile sp-electron distribution gives rise to electrostatic forces. It was indicated that these forces are a major contribution to the initial relaxing forces on the outermost ions at a d-band metal surface. Numerical estimates for the (001) face of alpha-Fe are given. Data show that for the surface ions, the surface Madelung force from the sp-electrons is inward and about 3 and 1/2 times stronger than an outward short range force simulating the effect of d-electrons. GRA

**N76-14944#** Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
**SOME NEW SERIES OF OXYGENATED VANADIUM COMPOUNDS AND LANTHANIDES OF PEROVSKITE STRUCTURE**
P. Dougier and A. Casalot 1975 22 p refs Transl. into ENGLISH from a French report Submitted for publication
(NRC/CNR-TT-1818; ISSN-0470-2557) Avail: NTIS HC $3.50

The development of the structural and electronic properties of series of perovskite type LA sub 1-x OxVO3, La sub 1-x SRxVO3, La sub 1-x BaxVO3, Gd sub 1-x SrxVO3 was studied. The transition from properties of semiconductor type to metallic properties is explained by the evolution of chemical bonds as a function of the composition. Author

**N76-14945#** Massachusetts Inst. of Tech., Cambridge.
**RESEARCH ON SEVERELY DEFORMED SUPERCONDUCTORS**
Robert M. Rose 27 Jun. 1975 64 p refs
(Contract DAHC04-72-C-0022)
(AD-A013492; ARO-9241.2-MC) Avail: NTIS CSCL 20/3

Severely deformed superconducting Nb behaves anomalously in several respects, including mixed-state RF loss and the inductive and resistive transitions. To measure the RF surface impedance as a function of magnetic field and frequency, a quarter-wave coaxial resonator in helical configuration was designed, analyzed and constructed. The results indicate that, as a function of frequency, mixed state RF loss is described very well by a two-fluid model without reference to loss mechanism other than that fluxon core excitations are involved. At present there is no explanation for structure sensitivity or the huge change in depinning frequency with cold work. Tunneling experiments were performed on single crystal and deformed Nb, and the data inverted by a numerical program to yield the electron-coupled spectrum (alpha squared) F and strong-coupling parameters lambda, mu and omega. GRA

**N76-14946#** Clemson Univ., S.C.
**TRANSPORT PROPERTIES IN ALKALI AZIDES Final Report, Feb. 1972 - Mar. 1975**
A. L. Laskar Jun. 1975 95 p refs
(Grant DA-ARO(D)-31-124-72-G120; DA Proj. 1T1-61102-B-11B)
(AD-A013531; CUP-101; ARO-9603.2-P) Avail: NTIS CSCL 20/13

Crystalline defects and ionic transport in potassium and rubidium azide have been studied by measuring the electrical conductivity with an a.c. bridge technique and the diffusion of cations by a tracer sectioning technique. Methods were developed to grow large and excellent quality single crystals of KN3 and RbN3 by the Kyropolous and solution growth techniques respectively. They were characterized by the X-ray diffraction patterns. A method also has been developed to directly observe dislocations in these crystals for the first time. GRA

**N76-14947#** Raytheon Co., Waltham, Mass. Research Div.
**MAGNETIC BUBBLE DEVICES Final Technical Report, 20 Jun. 1974 - 20 Jun. 1975**
Ernst Schloemann and H. J. VanHook Jun. 1975 131 p refs
(Contract N00014-74-C-0369; RR0110201; NR Proj. 018-823)
(AD-A013600; S-1889) Avail: NTIS CSCL 20/2

The effect of an in-plane anisotropy on the static and dynamic wall structure has been calculated. The results show that the critical velocity, at which wall motion becomes unstable, will be much higher in films with a strong in-plane anisotropy than in films without this anisotropy. A new method of generating the desired in-plane anisotropy by means of strain is described. The maximum strain that can be achieved is limited primarily by cracking of the substrates, and is approximately 0.0005 for GGG. The theory of wall motion at relatively low speeds has been extended by solving the differential equation for the wall-structure by means of the WKB approximation. The results show that the wall mass is nonuniform, having peaks that are associated with the critical points of the static wall structure. A theory of domain wall motion induced by microwave magnetic fields has been developed. Author (GRA)

**N76-14948#** Massachusetts Inst. of Tech., Cambridge. School of Engineering.
**SUPERCONDUCTORS IN LARGE SYNCHRONOUS MACHINES Final Report**
Joseph L. Smith Jun. 1975 168 p refs
(PB-243871/1; EPRI-RP-92-FR) Avail: NTIS HC $6.75 CSCL 10B

The objectives of the program were to establish a sound base for this technology, and to demonstrate its prospects, as well as to encourage the involvement of equipment manufacturers. In the course of the program, two experimental superconducting alternators were built and tested. Extensive analysis and exploratory design work was performed. Administrative data, descriptions of experiments, discussion of analysis, machine design philosophy, and a summary of continuing work are included. The significant conclusion is that it is possible to construct turboalternators and synchronous condensers which offer significant advantages over conventional machines. GRA

**N76-14949#** Little (Arthur D.), Inc., Cambridge, Mass.
**STUDY, DESIGN AND FABRICATE A COLD CRUCIBLE SYSTEM Final Report, 1 Nov. 1973 - 28 Feb. 1975**
Joseph F. Wenckus, Martin L. Cohen, Alfred G. Emslie, Wilson P. Menashi, and Peter F. Strong 31 Mar. 1975 79 p refs
(Contract F19628-74-C-0097; AF Proj. 5620)
(AD-A013779; AFCRL-TR-75-0213) Avail: NTIS CSCL 20/2

The objective of this program was to conduct a study, design and fabricate a cold crucible system for the synthesis and crystal growth of refractory semiconductors and oxides. A theoretical analysis of the cold crucible relating the properties of the material to the electrical characteristics of the cold crucible was completed. The thermal analysis, which includes thermal modeling by means of a computer technique, was also completed. A detailed analysis of the RF power control system necessary to provide the desired stability for crystal growth was also carried out. Using a 50 Kw (4-7 megahertz) RF power supply the cold crucible assembly was tested and kilogram melts of zirconia (melting point 2690C) were successfully contained. GRA

**N76-14950#** Aerospace Research Labs., Wright-Patterson AFB, Ohio. Applied Mathematics Research Lab.
**A QUASI ONE-DIMENSIONAL APPROACH TO ELASTIC-PLASTIC PROBLEMS OF SOLID MECHANICS Interim Report, Jan. - Dec. 1974**
Karl G. Guderley Jun. 1975 92 p refs
(AF Proj. 7071)
(AD-A013685; ARL-75-0136) Avail: NTIS CSCL 20/12

A major part of this report is a compilation in rather elementary terms of facts from the theory of elastic, plastic, and elastic-plastic plane solid mechanics, as far as they are useful for a numerical approach. The discussion includes the basic concepts, the question of the continuity of stresses along the elastic-plastic boundary, minimum principles, the theory of characteristics for the stresses, the stress rates and the strain rates in the plastic region, and some facts from plane elasticity theory which allow one to formulate the purely elastic problem as a pair of integral equations in which the unknown functions depend only upon one independent variable, say, the arc length of the boundary of the elastic region. The solution of the differential equations in the plastic region can be found by means of the method of characteristics (provided that the partial differential equations in this region are hyperbolic). On this basis it is possible to devise an algorithm in which the elastic and the plastic region are properly matched. GRA

**N76-14951#** Aerospace Research Labs., Wright-Patterson AFB, Ohio. Solid State Physics Lab.
**CALCULATIONS OF 3 - 5 SEMICONDUCTOR PROPERTIES Final Report, 1 Jul. 1974 - 30 Jun. 1975**
Sang Boo Nam Jun. 1975 22 p refs
(AF Proj. 7885)
(AD-A013684; ARL-75-0153) Avail: NTIS CSCL 20/12

The authors have developed a phenomenological scheme which accounts well for the observations of the exciton energy spectra in GaAs in the intermediate magnetic field regime, that is, where the magnetic energy is of the order of the coulomb energy. They have formulated a new method for calculating the g-factors in solids and applied it to obtain the values of the g-factors in conducting electron states in InP and GaAs. The calculated values of 1.24 for InP and 0.485 for GaAs agree with the experimental values of 1.20 + or - 0.05 for InP and 0.45 + or - 0.05 for GaAs. The initial formulation for calculating the transport properties in semiconductors has been established and the initial computer coding to calculate the above has been done. A prediction of obtaining coherent radiations from superconducting multijunctions is made. It appears that the surface states reduce the superconducting transition temperature. GRA

**N76-14952#** Northeastern Univ., Boston, Mass. Dept. of Physics.
**STUDY OF THE RELATIONSHIP BETWEEN ELECTROMAGNETIC AND ELASTIC PROPERTIES OF SOLIDS AND FLUIDS Final Report, 1 Nov. 1972 - 31 Dec. 1974**
Petros N. Argyres Jan. 1975 25 p refs
(Contract F19628-73-C-0132; DNA Proj. NWED-QAXS-B101)
(AD-A013789; AFCRL-TR-75-0056) Avail: NTIS CSCL 20/12

Three approaches to the central problem are discussed. The first is an unsuccessful attempt, which however provides a useful critique of projection operator techniques. The second is only a partially successful approach, through the use of a semiphenomenological model of a dielectric. The third, which is described in some detail, constitutes a successful approach and yields a very general and rigorous connection between the elastic and electromagnetic tensors of a very general model of a solid. GRA

**N76-14953#** Fairleigh Dickinson Univ., Teaneck, N.J.
**IMPERFECTIONS IN METASTABLE CRYSTALS AND THEIR RELATION TO STABILITY Final Report, 17 Mar. 1967 - 16 Oct. 1974**
Oswald Haase 20 Apr. 1975 12 p refs
(Grants DA-ARO(D)-31-124-G903; DA-ARO(D)-31-124-G1006; DA Proj. 1C0-14501-A-32B)
(AD-A013587; ARO-6731.3-C) Avail: NTIS CSCL 20/2

In order to localize the decomposition sites in solid Ba, K and Na Azides i.e., whether the decomposition occurs (1) homogeneously through the solid or (2) at dislocation sites inside the crystal or (3) on the surface, X-ray diffraction, X-ray topography, electron diffraction, optical microscopy and gas emission studies were made. The results indicate that the decomposition in its very first stage occurs at or near the surface at a few individual sites. It is not known whether these sites coincide with the emergence of dislocations from the interior. However, the density of sites is much smaller than the density estimated from X-ray topography measurements. GRA

# 77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

**N76-14954** Cornell Univ., Ithaca, N.Y.
**LOW TEMPERATURE THERMAL PROPERTIES OF GRANULAR MATERIALS Ph.D. Thesis**
Richard Haynesworth Tait 1975 191 p
Avail: Univ. Microfilms Order No. 75-27864

The low temperature specific heat and thermal conductivity of a variety of structurally disordered materials were measured to determine whether or not the low temperature excess specific heat and anomalous thermal conductivity of glasses are associated with grainy structures that are postulated to exist in glasses. The materials examined--pressed powders, sintered ceramics, glass ceramics, phase separated glasses, and recrystallized glasses-all had granular structures with grain sizes varying from 70 A to 30 microns (3 x 10 to the 5th power A). From the samples studied, no correlation of glassy thermal properties with granular structures was found. While the granular structures did significantly affect the thermal conductivity and specific heat of these materials, only those samples with atomic or molecular disorder showed glassy behavior at low temperatures, and this glassy behavior was not dependent on the size or existence of the grains composing the sample. Dissert. Abstr.

**N76-14955** Carnegie-Mellon Univ., Pittsburgh, Pa.
**LOW TEMPERATURE PROPERTIES OF SOME INTERMETALLIC COMPOUNDS Ph.D. Thesis**
George Boh Ouyang 1975 164 p
Avail: Univ. Microfilms Order No. 75-19859

The specific heat of HgIn and AuSn was measured between 0.4 K and 4.2 K, while the specific heat of AuSb2 has been obtained from 1.4 K to 4.2 K. For HgIn, the critical field has been measured between 0.3 K and 3.81 K. Below 1.3 K the specific heat for HgIn in the normal state is given by the equation C sub N = 3.75T + 4.88T cubed mJ/mole- K, the T cubed term corresponding to a Debye temperature of 92.7 K. The transition temperature and the critical field at 0 K are 3.807 + or - .005 K and 350.5 + or - .5 gauss, respectively. Good thermodynamic consistency is found between the critical field and specific heat data. Based on measured electronic specific heat coefficients, the number of conduction electron provided by each molecule was calculated for all three intermetallic compounds. The results seem to suggest that not all valence electrons go to the conduction bands in AuSb2 and HgIn, while in AuSn the free-electron-gas model is quite adequate for all the valence electrons. Dissert. Abstr.

**N76-14956** Utah State Univ., Logan.
**SOME HIGH TEMPERATURE KINETIC AND THERMODYNAMIC PROPERTIES OF MATTER Ph.D. Thesis**
An-Lu Leu 1975 112 p
Avail: Univ. Microfilms Order No. 75-28873

At high temperatures the breaking of chemical bonds becomes relatively easy and the slow step in a chemical reaction shifts to the rate at which energy can seep into the bond that is to break. A general theory of reactions was developed to explain this limiting rate at high temperature. In the case of cyclopropane and cyclobutane, the theory leads to the conclusion that 20 degrees of freedom form a heat reservoir which feeds the energy

into the carbon bond that is to break and that this rate becomes controlling. This theory is important for shock tubes and detonations where this falling off from the extrapolated low temperature rate becomes obvious. The initiation, support, and propagation of reaction rates travelling with a velocity approaching or equalling the velocity of sound are considered. The significant structure theory of liquids was used to write a partition function for molten magnesium oxide taking account of the decomposition of MgO to Mg and O2 in the gas-like part of the partition function. Equations are derived from which the melting point, boiling point, entropy, compressibility, coefficient of thermal expansion, specific heat, viscosity, self-diffusion coefficient, and specific conductance are calculated. Dissert. Abstr.

**N76-14957*#** Transemantics, Inc., Washington, D.C.
**DIAGRAM OF THE ENTROPY-TEMPERATURE OF THE EQUILIBRIUM PHASES OF A LITHIUM BROMIDE SOLUTION IN WATER**
L. M. Rosenfeld, Yu. V. Kuzmitskiy, and G. A. Paniyev Washington NASA Dec. 1975 9 p refs Transl. into ENGLISH from Izv. Sibirsk. Otd. Akad. Nauk SSSR, Ser. Tekhn. Nauk (USSR), no. 3, issue 1, 1971 p 70-73
(Contract NASw-2792)
(NASA-TT-F-16804) Avail: NTIS HC $3.50 CSCL 20M

The thermodynamic properties of an aqueous lithium bromide solution were studied. An enthalpy diagram of a solution of lithium bromide in water and several tables were prepared on the basis of experimental data. The available data also made it possible to prepare an entropy diagram of the aqueous lithium bromide solution and it can be used for the thermodynamic analysis of combined cycles of an absorptive lithium bromide refrigerator and heat transformers. Author

# 80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

**N76-14958#** Lincoln Lab., Mass. Inst. of Tech., Lexington.
**EDUCATIONAL TECHNOLOGY PROGRAM Quarterly Technical Summary Report, 1 Sep. - 30 Nov. 1974**
Frederick C. Frick 15 Dec. 1974 15 p refs
(Contract F19628-73-C-0002; AF Proj. 469L)
(AD-A005325; ESD-TR-74-342) Avail: NTIS CSCL 05/9

Improvements in system software and other author support systems are discussed. The cam-driven fiche selector was cycle-tested, and the problem of envelope scratching was investigated. An alternative reader was designed and fabricated. Author (GRA)

# 81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

**N76-14959** California Univ., Los Angeles.
**INTERACTIVE PROCEDURES FOR EVALUATION OF MULTI-ATTRIBUTED ALTERNATIVES Ph.D. Thesis**
Rakesh Kumar Sarin 1975 153 p
Avail: Univ. Microfilms Order No. 75-26987

Procedures were developed for aiding a decision maker in the selection of multi-attributed decision alternatives. The procedures developed can be implemented conveniently on an on-line interactive computer. A common strategy of sequential evaluation is employed by these procedures. In this strategy, the information from the decision maker is solicited sequentially until a preferred choice is determined. The sequential strategy involves two phases. In one phase, the analyst (or computer) performs analysis to exclude some decision alternatives. In the other phase, the decision maker supplies some information to the analyst. These phases can be coordinated on an interactive, on-line computer terminal, where the computer does the analysis and queries the decision maker for certain decisions as and when required. Based on these decisions, further computations are made, and the procedure terminates when a preferred decision is identified. Dissert. Abstr.

**N76-14960#** Research Inst. of National Defence, Stockholm (Sweden).
**INFORMATION, UNCERTAINTY, AND ADAPTIVE PLANNING**
Per Strangert May 1974 154 p refs
(FOA-P-C-8392-M3) Avail: NTIS HC $6.75

The role and nature are investigated of formal criteria for the evaluation of strategies in planning when uncertainty is expected to resolve over time. After the description of a practical defense planning process, a classification of uncertainty with respect to its change over time is introduced which serves to define the concept of uncertainty resolution over time. A number of applications of multistage decision-making are studied. From these are derived a set of requirements for a formal description to be applicable to practical planning. A formalism is proposed, founded upon the concept of uncertainty about the future state of information. Author

**N76-14961*#** National Aeronautics and Space Administration, Washington, D.C.
**RESEARCH AND TECHNOLOGY OPERATING PLAN. SUMMARY: FISCAL YEAR 1976 RESEARCH AND TECHNOLOGY PROGRAM**
1976 178 p
(NASA-TM-X-72913) Avail: NTIS HC $3.50 CSCL 05A

A compilation of the summary portions of each of the Research and Technology Operating Plans (RTOP) used for management review and control of research currently in progress throughout NASA was presented. The document is arranged in five sections. The first one contains citations and abstracts of the RTOP. This is followed by four indexes: subject, technical monitor, responsible NASA organization, and RTOP number. Author

**N76-14962#** Air Force Systems Command, Washington, D.C.
**LABORATORY PROGRAM MANAGERS GUIDE. PART 1: STATEMENT OF WORK PREPARATION**
Jun. 1975 96 p
(AD-A013967; AFSC-TR-75-02-Pt-1) Avail: NTIS CSCL 05/2

The primary objective of this guide is to provide laboratory level project engineers with a systematic approach for Statement of Work (SOW) preparation. The systematic approach presented should enable a project engineer to review and understand all factors that bear on this project BEFORE the Statement of Work is attempted. Statement of work review procedures are recommended to assist the project engineer identifying and correcting any gaps between what he intended to write and what he has actually written. The need and purpose for format consideration is also discussed. GRA

**N76-14963#** Naval Postgraduate School, Monterey, Calif.
**MANAGEMENT BY OBJECTIVES AT A RESEARCH, DEVELOPMENT, TEST AND EVALUATION ACTIVITY M.S. Thesis**
Larry Eugene Blose and Michael Jerome Stansel Jun. 1975 131 p refs
(AD-A013627) Avail: NTIS CSCL 05/1

NAVMAT Instruction 5200.37 of 24 September 1973 required a Management by Objectives (MBO) program to be initiated throughout the Naval Material establishment. The Pacific Missile Range (PMR) at Point Mugu, California requested assistance from the Naval Postgraduate School in establishing their MBO program. A pilot MBO program was established at PMR to determine MBO's feasibility in a research and development (R and D) organization. Due to time constraints, the program was limited to the implementation of short range goals and objectives. GRA

**N76-14964#** Office of Naval Research, London (England).
**CENTRALIZATION AND VIGOR. PART 2: ORGANIZATION AND FUNDING OF RESEARCH IN FRANCE**
Philip L. Stocklin 18 Jul. 1975 26 p refs
(AD-A013782; ONRL-R-11-75-Pt-2) Avail: NTIS CSCL 05/1

French scientific activity is characterized by centralization of planning, administration and funding, together with a vigor resulting from a highly developed research infrastructure of

cross-Ministry, interdisciplinary work flow and communication, together with a mix of longevity funding and specific project support. Major features of the current French National Plan, the Sixth Plan, are summarized as they affect research. National organization for research, centered on a controlling agency in the Ministry of Industry and Trade, is outlined. Funding by Ministry and by field of research for 1974 is given, together with illustrations of organization and infrastructure including the computer industry and oceanography. GRA

# 82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

**N76-14965** Michigan Univ., Ann Arbor.
**PRODUCING AN ORGANIZATIONAL PLAN FOR COMPUTERIZED INFORMATION SYSTEM DEVELOPMENT Ph.D. Thesis**
David Martin Carlson 1975 120 p
Avail: Univ. Microfilms Order No. 75-29187

A procedure by which an organization may develop a formal computer system development plan to build specific CBIPS is validated by a demonstration. The procedure is based on a description of the environment in which computer system development takes place. The environment described includes an abstract model of computer system development. An organization's existing plan may be used as an input to the procedure. Computer aids to the procedure are also given and demonstrated. Dissert. Abstr.

**N76-14966*#** Florida State Univ., Tallahassee. School of Library Science.
**PATTERNS OF AVAILABILITY AND USE OF AUDIOTAPE CASSETTES IN SPECIAL LIBRARIES Ph.D. Thesis**
J. Marshal Hughes, II 1975 157 p refs Sponsored by NASA
(NASA-TM-X-72910) Avail: NTIS HC $6.75 CSCL 05B

The availability and use of audiotape cassettes is studied in terms of user requirements. The following factors were examined: how special libraries utilize audiotape cassettes; who the users of the medium are; how the libraries acquire and maintain their collection; and opinions of librarians as to the value of the audiotape cassette as a medium for dissemination of information. J.M.S.

**N76-14967#** Capital Systems Group, Rockville, Md.
**PLANS AND RECOMMENDATIONS FOR ESTABLISHING AND OPERATING A CLEARINGHOUSE FOR INNOVATION IN SCIENTIFIC COMMUNICATION**
William A. Creager, John M. Strawhorn, and Richard L. Omerson 31 Mar. 1975 32 p
(Contract NSF C-950)
(PB-243461/1) Avail: NTIS HC $4.00 CSCL 05B

Innovations applicable to the primary dissemination of scientific and technical information are presented. The fundamental recommendation is for the establishment of a Clearinghouse for Innovation in Scientific Communication. It is recommended that the Clearinghouse's first activity be the publication of a guidebook that would describe innovations applicable to primary dissemination of scientific and technical information. Recommendations and tentative plans are also presented for the gradual enlargement of the Clearinghouse's scope, to include, within the first year of operation, the secondary and tertiary dissemination of information. GRA

**N76-14968#** Naval Postgraduate School, Monterey, Calif.
**FEASIBILITY STUDY FOR ESTABLISHING AN AUTOMATED DATA BASE SYSTEM FOR NAVAL ELECTRONICS ENGINEERING CENTER, VALLEJO M.S. Thesis**
James Edward Tarver Jun. 1975 67 p refs
(AD-A013623) Avail: NTIS CSCL 05/9

The purpose of the feasibility study is to establish an automated data base system for Naval Electronics Engineering Center, Vallejo, California. The three divisions, namely, the financial, procurement and program manager's divisions, were analyzed as a separate entity by taking their present methods of operation and determining which methods lend themselves to automation and propose a conceptual EDP system to handle the new data structure. After combining the applications of each division, a file design structure along with the associated hardware equipment and recommendations for further evaluating the overall performance of the system were supplied for NAVELEX. GRA

**N76-14969#** Shape Air Defense Technical Center, The Hague (Netherlands).
**DESIGN AND EVALUATION OF INFORMATION SYSTEMS**
W. R. OBrien Jun. 1975 16 p
(AD-A013647; STC-PP-107) Avail: NTIS CSCL 05/1

The objective of this paper is to bring forward some of the more significant characteristics of various management strategies and to assess their impact on the requirements of a laboratory management information system. The management strategies are classified according to three schools: the Classical, the Behavioral, and the Systems. The Classical is shown to have a top down orientation, with management giving the orders and the working-level scientists being expected to carry them out. The Behavioral School puts great emphasis on the informal organization and the attitudes, sentiments, and interactions of the group members. The objective is to try to assure that the group members can achieve fulfilment by cooperating in the achievement of organizational goals. The Systems School integrates much of the theory of the other two, adding emphasis to the environment as well as organizational adaptation. GRA

**N76-14970#** Patent and Trademark Office, Washington, D.C. Office of Technology Assessment and Forecast.
**TECHNOLOGY ASSESSMENT AND FORECAST, FIFTH REPORT Semiannual Report**
Aug. 1975 169 p ref
(COM-75-11142/7; PAT-037.0-7508; SAR-5) Avail: NTIS HC $6.75 CSCL 05B

Patent activity in 56 technological areas experiencing either high rates of growth or unusually heavy patenting by residents of foreign countries was reviewed. Three of these areas -- Prostaglandins, color electrophotography, and gas lasers - are the subjects of special substantive reports prepared by patent examiners in the respective fields. The report also presents patent activity data in 36 broad product field categories corresponding to the standard industrial classification (SIC) system. GRA

**N76-14971#** National Archives and Records Service, Washington, D.C. Div. of Machine-Readable Archives.
**A STUDY OF DATA MANAGEMENT POLICIES IN FEDERAL SCIENTIFIC DATA CENTERS Final Report**
William A. Reader and Jon E. Updike Jun. 1975 119 p
(PB-243668/1) Avail: NTIS HC $5.50 CSCL 05B

The report studies data management policies in the following five scientific data centers: (1) National Oceanographic Data Center (NOAA), (2) Earth Resources Observational System Data Center (Geological Survey), (3) National Air Data Branch (EPA), (4) National Space Science Data Center (NASA), and (5) National Standard Reference Data System (National Bureau of Standards). The study describes and analyzes the history, mission and scope of operations, organization, staffing, data acquisition policies, data services, and costs for each center individually, and then makes comparisons between the centers in each of the above categories. GRA

# 83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

**N76-14972#** Joint Economic Committee (U. S. Congress).
**NATIONAL PRIORITIES AND FEDERAL RESEARCH AND DEVELOPMENT PROGRAMS**

Washington GPO 1974 240 p refs Hearings before Subcomm. on Priorities and Economy in Govt. of Joint Economic Comm., 93d Congr., 2d Sess., 20-22 May 1974
(GPO-40-686) Avail: SOD HC $2.25

Selected aspects of Federal spending for research and development were studied in order to gain an insight into how resources in this area are used. Topics discussed include waste processing, petroleum production processes, cost analysis, methanol, synthetic alcohols, ethanol production, solid wastes, oil shale utilization, gasoline, and solar energy. M.J.S.

**N76-14973#** Committee on Interstate and Foreign Commerce (U. S. House).
**STANDBY ENERGY EMERGENCY AUTHORITIES ACT**
Washington GPO 1974 357 p refs Hearings on H.R. 13834 before Comm. on Interstate and Foreign Commerce, 93d Congr., 2d Sess., 2-4 Apr. 1974
(GPO-32-544) Avail: Comm. on Interstate and Foreign Commerce

A legislative act to provide energy to meet the energy crisis is presented. Topics discussed are: (1) the Arab oil embargo, (2) supply and demand factors for oil, (3) alternate fuel supplies other than oil, (4)oil monopolies, (5) the effect of energy shortages on unemployment and other aspects of the economy, and (6) energy conservation measures. J.R.T.

**N76-14974*#** Aerospace Corp., El Segundo, Calif. Advanced Orbital Systems Div.
**STUDY OF THE COMMONALITY OF SPACE VEHICLE APPLICATIONS TO FUTURE NATIONAL NEEDS (UNCLASSIFIED PORTION)**
24 Mar. 1975 407 p ref
(Contract NASw-2727)
(ATR-75(7365)-2) Avail: NTIS HC $11.00 CSCL 05C

A midterm progress report was presented on the study of commonality of space vehicle applications to future national needs. Two of the four objectives in the entire study were discussed. The first one involved deriving functional requirements for space systems based on future needs and environments for the military and civilian communities. Possible space initiatives based on extrapolations of technology were compiled without regard as to need but only with respect to feasibility, given the advanced state of technology which could exist through the year 2,000. The second one involved matching the initiatives against the requirements, developing a methodology to match and select the initiatives with each of the separate plans based on the future environments, and deriving common features of the military and civilian support requirements for these programs. Author

**N76-14975#** Air Force Avionics Lab., Wright-Patterson AFB, Ohio.
**COST-ESTIMATING RELATIONSHIPS USING LINEAR, LOG-LINEAR AND NON-LINEAR REGRESSION Final Report, Aug. 1974 - Jan. 1975**
J. E. Bilikam Apr. 1975 20 p refs
(AD-A013928; AFAL-TR-75-43) Avail: NTIS CSCL 15/5

The report addresses the use of weighted regression for linear cost estimating relationships and non-linear regression for log-linear cost estimating relationships with the trends in residual distributions. GRA

**N76-14287*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 1: OBJECTIVES AND APPROACH**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 2-21 refs (For availability see N76-14286 05-31)
CSCL 05C

**N76-14292*** Mathematica, Inc., Princeton, N.J.
**CHAPTER 6: CONCLUSIONS AND IMPLICATIONS**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 128-133 ref (For availability see N76-14286 05-31)
CSCL 09C

**N76-14293*** Mathematica, Inc., Princeton, N.J.
**APPENDIX A: INTERMEDIATE GOOD AND CONSUMERS' SURPLUS**
*In its* Quantifying the Benefits to the Natl. Economy from Secondary Appl. of NASA Technol. 30 Jun. 1975 p 135-176 (For availability see N76-14286 05-31)
CSCL 09C

# 84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

**N76-14976#** Committee on Commerce (U. S. Senate).
**COASTAL ZONE MANAGEMENT ACT AMENDMENTS OF 1974**
Washington GPO 1974 12 p Rept. to accompany S. 3922 presented by Comm. on Commerce at the 93d Congr., 2d Sess., 17 Dec. 1974
(S-Rept-93-1362; GPO-38-010) Avail: US Capitol, Senate Document Room

The Commerce committee held hearings on amendments to the Coastal Zone Management Act of 1972, and recommended that they be passed. The bill provides more flexibility in the allocation of administrative grants to coastal States and local governments. Three types of grants are available: management program development grant, administrative grant, and estuarine sanctuary grant. J.A.M.

**N76-14977#** Committee of Conference (U. S. Congress).
**FEDERAL FIRE PREVENTION AND CONTROL ACT OF 1974**
Washington GPO 1974 31 p Rept. to accompany S. 1769 presented by Comm. of Conf. at the 93d Congr., 2d Sess., 2 Oct. 1974
(S-Rept-93-1211; GPO-38-010) Avail: US Capitol, Senate Document Room

A legislative act is presented which allows for the development of fire technology by establishment of a National Academy. The development of training programs for all types of fires is discussed. Research and development (i.e., combustion physics of fire) is also discussed. Costs of the various programs are given. J.R.T.

# 85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

**N76-14978** British Library Lending Div., Boston Spa (England).
**A THEORETICAL TREATMENT OF BATTERY POWERED VEHICLES**
A. Walz [1975] 36 p refs Transl. into ENGLISH from Elektrotech. Z., A. (West Ger.), v. 94, no. 11, Nov. 1973 p 622-631
(BLL-OA-Trans-1390-(6196.3)) Avail: British Library Lending Div., Boston Spa, Engl.: 4 BLL photocopy coupons

A theoretical treatment of battery powered land vehicles was presented, including a treatment of the problems of energy conversion efficiency throughout the whole of the battery and drive system. Exact calculations of the torque and horse-power requirements at the driving wheels for practically any selected travel pattern was given and illustrated by typical examples. The calculation of losses in the battery and drive required the introduction of empirical laws with associated interpolation formulas. The resulting semi-empirical theory of battery-powered vehicles deals, in simple analytical form, with questions arising in the design optimization of such vehicles, such as the proportion of the vehicle weight required for the battery, or the operating range of the vehicle, or its haulage capacity. Author

**N76-14979*#** Virginia Univ., Charlottesville. School of Engineering and Applied Science.
**INTEGRATED MASS TRANSPORTATION SYSTEM STUDY/ DEFINITION/IMPLEMENTATION PROGRAM DEFINITION**
R. K. Ransone, D. A. Deptula, and G. G. Yorke Dec. 1975 34 p
(Grant NGR-47-005-181; Contract DOT-OS-30097)
(NASA-CR-145961; ESS-4764-102-75) Avail: NTIS HC $4.00 CSCL 05A

Specific actions needed to plan and effect transportation system improvements are identified within the constraints of limited financial, energy and land use resources, and diverse community requirements. A specific program is described which would develop the necessary generalized methodology for devising improved transportation systems and evaluate them against specific criteria for intermodal and intramodal optimization. A consistent, generalized method is provided for study and evaluation of transportation system improvements. Author

**N76-14980#** Civil Aeronautics Board, Washington, D.C.
**THE DOMESTIC ROUTE SYSTEM: ANALYSIS AND POLICY RECOMMENDATIONS**
Oct. 1974 250 p
Avail: NTIS HC $8.00

A study of the domestic airlines route system was completed. The following conclusions and recommendations were reached: (1) the system has offered, in general, an overall volume of service that is excessive in relation to demand in competitive markets, due primarily to the rate level and the fare taper; this assessment is based on data obtained prior to the fuel allocation program and the very large increases in petroleum input costs, (2) traffic growth for the period to 1985 will be at about one-half the rate experienced in the post-World War II period, (3) the award of new or additional route authority will take place at a slower rate than heretofore; regulatory route and route-related policies should be directed to improving the efficiency and quality of the system through a careful expansion of route authority when required by traffic, and through route rationalization. Author

**N76-14981#** Pennsylvania State Univ., University Park. Center for the Study of Science Policy.
**SOURCES AND USES OF SCIENTIFIC AND TECHNOLOGICAL INFORMATION IN STATE LEGISLATURES Final Report, 1 Jul. 1972 - 31 Dec. 1974**
Robert E. OConner, Michael R. King, Donald C. Menzel, and Peter A. Wissel 31 Dec. 1974 252 p
(Grant NSF GT-34868)
(PB-243551/9; NSF/RA/G-75/017) Avail: NTIS HC $9.00 CSCL 05B

The study examines the sources and uses of scientific and technological information in state legislatures, and legislators' recommendations for improvement in the information capabilities of their legislatures. The research is based on interviews with 341 state legislators, and with selected legislative staff in eight states. The study focuses on four interrelated questions: (1) to what extent do state legislators perceive the scientific and technological import of issues, (2) to whom do legislators go for advice on such issues, (3) what is the perceived utility or feasibility of various existing or proposed mechanisms for improving legislators' access to scientific and technological information, and (4) what recommendations do state legislatures make as to approaches not yet attempted. GRA

**N76-14982#** Virginia Research, Inc., Arlington.
**TODAY'S R AND D BUILDING A BASE FOR BETTER TRANSPORTATION Final Report**
15 Apr. 1975 46 p
(Contract DOT-OS-50101)
(PB-243667/3; DOT-TST-75-111) Avail: NTIS HC $4.00 CSCL 13B

A concept of a strategic R and D plan for the Department of Transportation is presented. The concept of a core program of R and D of the DOT core program is presented in its present stage of development. The plan shows the relationship within the DOT between socio-economic R and D and R and D in the areas of engineering and in the physical, technical, and life sciences, and presents scenarios for the time frame circa 2000 A.D. for transportation systems for urban passenger, intercity passenger, and freight. Against this background, ongoing R and D programs are described as practical examples of the foregoing conceptual structure. GRA

**N76-14983#** Modern Army Selected Systems Test Evaluation and Review, Fort Hood, Tex.
**SELF-CONTAINED VEHICLE LAND NAVIGATION SYSTEMS (V-NAV) TEST 2 REPORT (V-NAV 2) Material Test Report, Jun. - Jul. 1974**
E. H. Rugenstein 6 Jan. 1975 147 p refs
(AD-A005584; MASSTER-Test-FM-237) Avail: NTIS CSCL 19/3

This report discusses the purpose, objectives, test methodology results and conclusions, and recommendations for self contained vehicle land navigation systems. Self contained land navigation systems provide a continuous display of the vehicle's position defined in 8-digit UTM coordinates. A compass readout is also provided noting the vehicle's heading. Self contained systems do not require any external signals or related equipment to operate, but are totally contained on the vehicle itself. The systems acquire heading input from either a magnetic compass, gyro or a combination of the two. Distance input is derived from the vehicle's transmission. GRA

## 88 SPACE SCIENCES (GENERAL)

**N76-14984*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
**MASS DISTRIBUTION OF ORBITING MAN-MADE SPACE DEBRIS**
T. Dale Bess Washington Dec. 1975 30 p refs
(NASA-TN-D-8108; L-10477) Avail: NTIS HC $4.00 CSCL 22A

Three ways of producing space debris were considered, and data were analyzed to determine mass distributions for man-made space debris. Hypervelocity (3.0 to 4.5 km/sec) projectile impact with a spacecraft wall, high intensity explosions and low intensity explosions were studied. For hypervelocity projectile impact of a spacecraft wall, the number of fragments fits a power law. The number of fragments for both high intensity and low intensity explosions fits an exponential law. However, the number of fragments produced by low intensity explosions is much lower than the number of fragments produced by high intensity explosions. Fragment masses down to 10 to the -7 power gram were produced from hypervelocity impact, but the smallest fragment mass resulting from an explosion appeared to be about 10 mg. Velocities of fragments resulting from hypervelocity impact were about 10 m/sec, and those from low intensity explosions were about 100 m/sec. Velocities of fragments from high intensity explosions were about 3 km/sec. Author

**N76-14985*#** Iowa Univ., Iowa City.
**RESEARCH IN SPACE PHYSICS AT THE UNIVERSITY OF IOWA Annual Report, 1975**
J. A. VanAllen Jan. 1976 39 p refs
(Contract NGL-16-001-002)
(NASA-CR-145977) Avail: NTIS HC $4.00 CSCL 22A

Energetic particles in outer space and their relationship to electric, magnetic, and electromagnetic fields associated with the earth, sun, moon, and planets, and the interplanetary medium are investigated. Special attention was given to observations of earth and moon satellites and interplanetary spacecraft; phenomenological analysis and interpretation were emphasized. Data also cover ground based on radio astronomical and optical techniques and theoretical problems in plasma physics as revelant to solar planetary and interplanetary phenomena. Author

# 89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

**N76-14986** Massachusetts Univ., Amherst.
**A LOCAL APPROACH TO COSMOLOGY Ph.D. Thesis**
Allan Martin Walstad 1975 99 p Prepared in cooperation with Hampshire Coll., Mt. Holyoke Coll., Smith Coll. and Amherst Coll.
Avail: Univ. Microfilms Order No. 75-27529

A local approach to cosmology was developed in which it is attempted to understand, from strictly local considerations, the principal observable properties of homogeneous cosmological models. The local line element was obtained for some simple general-relativistic models. The optical appearance of distant objects, number counts, and the effects of local inhomogeneities on such observations are discussed in the isotropic case. The concept of the partitioned universe, in which physical conditions are mimicked by conditions inside a small, expanding cell with perfectly reflecting walls, was developed as a tool for simplifying the discussion of the background radiation, Olbers' paradox, the temperature and physical state of the cosmological fluid, entropy generation, and the effects of anisotropic expansion. This treatment revealed a possible error in Weinberg's (1971) discussion of bulk viscosity and entropy generation in the early universe.
Dissert. Abstr.

**N76-14987** Arizona Univ., Tucson.
**PROPERTIES OF CEPHEID VARIABLES IN THE LARGE MAGELLANIC CLOUD Ph.D. Thesis**
Leo Paul Connolly 1975 167 p
Avail: Univ. Microfilms Order No. 75-26929

The B and V magnitudes were determined for 135 cepheids in the northwest section of the Large Magellanic Cloud (LMC). Photoelectric sequences were used to reduce the magnitudes and determine the reddening in their vicinity. A uniform reddening of 0.06 was found. Usable light curve parameters are given for 119 cepheids. The cepheids form a homogeneous sample with no detectable variation in their properties. The period-luminosity relation has a smaller slope than previously found because the sample of short period cepheids is more complete and contains some cepheids bluer and brighter than normal. Using twelve Galacitc cepheids with known absolute magnitudes, the period-luminosity relation gives a distance modulus of 18.56 for the LMC. The colors of the cepheids correlated with the residuals from the period-luminosity relation for long periods only.
Dissert. Abstr.

**N76-14988** Maryland Univ., College Park.
**HIGH RESOLUTION RADIO OBSERVATIONS OF SUPERNOVA REMNANTS Ph.D. Thesis**
Robert Howard Becker 1975 169 p
Avail: Univ. Microfilms Order No. 75-28731

Radio observations are discussed for 3.7 and 11.1 centimeter wavelengths of four supernova remnants (G11.2 - 0.4, G21.5 - 0.9, G29.7 - 0.3, and 3C391), an H II region (G45.5 + 0.1), and a radio galaxy (3C386). The supernova remnant G21.5 - 0.9 has an elliptical brightness distribution and is similar to the Crab Nebula and 3C58 in appearance. The two remnants G29.7 - 0.3 and 3C391 both showed a broken shell structure typical of most galactic supernova remnants. The observations of the radio galaxy 3C386 revealed an extended double source and an unresolved source at the nucleus with a steep nonthermal spectrum. An analysis of galactic supernova remnants shows that there is a relationship between spectral index and z-distribution. Remnants with flat spectra were found at greater distances from the galactic plane on the average than were the remnants with steep spectra. The difference in z-distances was attributed to a population difference between flat- and steep-spectrum remnants.
Dissert. Abstr.

**N76-14989** Maryland Univ., College Park.
**CARBON MONOXIDE EMISSION FROM INTERSTELLAR DUST CLOUDS Ph.D. Thesis**
Andrew Stuart Milman 1975 100 p
Avail: Univ. Microfilms Order No. 75-29123

Observations of the J = 1-0 rotational lines (C-12)(O-16) and (C-13)(O-16) in the North America nebula dust clous and L1630 were made. Bright CO emission from the directions of H alpha emission stars in L1630 and the North America dust cloud was sought, but no significant differences were found. It was concluded that these stars are too cool to heat the gas appreciably. The shapes of the CO profiles were determined by the large scale motions of the gas in the dust clouds. The possibility that magnetic fields prevent rapid dissipation of turbulent motions in the clouds was considered. Profiles observed near NGC 2023 indicate that the gas motions there are turbulent. In addition, observations of the North America dust cloud revealed that not more than about 10% of the carbon is in the form of CO. A model of CO excitation in a homogenous, spherical cloud with a constant source function is also described. Dissert. Abstr.

**N76-14990*#** Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
**FAR INFRARED SPECTROSCOPY OF H II REGIONS Ph.D. Thesis**
Dennis Brien Ward Nov. 1975 111 p refs
(Grant NGR-33-010-146)
(NASA-CR-145960; CRSR-613) Avail: NTIS HC $5.50 CSCL 03A

The far infrared spectra of H II regions are investigated. A liquid helium cooled grating spectrometer designed to make observations from the NASA Lear Jet is described along with tests of the instrument. The observing procedure on the Lear Jet telescope is described and the method of data analysis is discussed. Results are presented from a search for the (O III) 88.16 micron line. An upper limit on the emission in this line is obtained and line detection is described. Results are compared to theoretical predictions, and future applications of fine structure line observations are discussed. Coarse resolution results are given along with calibration problems. The spectra obtained are compared to models for dust emission. J.M.S.

**N76-14991*#** Martin Marietta Corp., Denver, Colo.
**PRELIMINARY DESIGN REPORT, LARGE SPACE TELESCOPE OTA/SI PHASE B STUDY: HIGH SPEED AREA PHOTOMETER**
15 Aug. 1975 159 p Sponsored by NASA
(NASA-CR-114701; MCR-75-298) Avail: NTIS HC $6.75 CSCL 20F

A photometer is examined which combines several features from separate instruments into a single package. The design presented has both point and area photometry capability with provision for inserting filters to provide spectral discrimination. The electronics provide for photon counting mode for the point detectors and both photon counting and analog modes for the area detector. The area detector also serves as a target locating device for the point detectors. Topics discussed include: (1) electronic equipment requirements, (2) optical properties, (3) structural housing for the instrument, (4) motors and other mechanical components, (5) ground support equipment, and (6) environment control for the instrument. Engineering drawings and block diagrams are shown. J.R.T.

**N76-14992*#** Hale Observatories, Pasadena, Calif.
**FURTHER OBSERVATIONS OF THE LAMBDA 10830 He LINE IN STARS AND THEIR SIGNIFICANCE AS A MEASURE OF STELLAR ACTIVITY**
H. Zirin Nov. 1975 28 p refs Prepared in cooperation with Carnegie Inst. of Washington, D. C. and Calif. Inst. of Technol., Pasadena
(Grants NGR-05-002-034; NSF GA-24015)
(NASA-CR-145974; BBSO-0150) Avail: NTIS HC $4.00 CSCL 03A

Measurements of the lambda 1030 He line in 198 stars are given along with data on other features in that spectral range. Nearly 80% of all G and K stars show some lambda 10830; of these, half are variable and 1/4 show emission. It was confirmed that lambda 10830 is not found in M stars, is weak in F stars, and is particularly strong in close binaries. The line is found in emission in extremely late M and S stars, along with P gamma, but P gamma is not in emission in G and K stars with lambda 10830 emissions. Variable He emission and Ti I emission are found in the RV Tauri variables R Scuti and U

Mon. In R Aqr the Fe XIII coronal line lambda 10747 and a line at lambda 11012 which may be singlet He or La II are found, as well as lambda 10830 and P gamma. The nature of coronas or hot chromospheres in the various stars is discussed. It was concluded that the lambda 10830 intensity must be more or less proportional to the energy deposited in the chromosphere corona by non-thermal processes. Author

**N76-14993#** Naval Research Lab., Washington, D.C.
**THE JULIAN DAY NUMBER FOR ANY GREGORIAN CALENDAR DATE AFTER 1900 Final Report**
John A. Eisele and Paul E. V. Shannon Aug. 1975 15 p refs (NRL Proj. B02-30)
(AD-A014077; NRL-MR-3100) Avail: NTIS CSCL 03/1

Compact formulas and FORTRAN subprograms are presented to compute the Julian day number, day of the week, and modified Julian day number for any Gregorian calendar date. The inverse problem of recovering the Gregorian calendar date from a known Julian day number is also presented. Basic astronomical applications are discussed as well as the precision requirements. GRA

**N76-14308*** Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Communications Systems Research Section.
**AUTOMATIC CONTROL OF DSS 13**
K. I. Moyd *In its* The Deep Space Network 15 Oct. 1975 p 107-114 refs (For availability see N76-14296 05-31)
CSCL 03A

# 90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

**N76-14994** New Mexico Univ., Albuquerque.
**A SATELLITE STUDY OF THE HIGH ENERGY PROTON ENVIRONMENT UNDER THE RADIATION BELT Ph.D. Thesis**
Kailash Chandra Dhingra 1975 114 p
Avail: Univ. Microfilms Order No. 75-28683

Proton data from outside of the South Atlantic Radiation anomaly was obtained by the high energy neutron and proton detector aboard OSO-6. Since the observed proton flux resulted from different source mechanisms, a procedure was developed to compute and separate the different contributions. New evidence substantiated the hypothesis that one or both of the processes of radial and pitch angle diffusion play active roles in the origin and distribution of the protons in the inner radiation belt. It was argued that these processes drive the trapped protons in the radiation belt into the regions where stable trapping is not possible. The diffusing flux was computed; however, certain assumptions might have led to an incorrect estimation of the diffusing protons flux. In addition, the flux and energy spectrum of the albedo protons were derived at three different regions. Dissert. Abstr.

**N76-14995** Saint Louis Univ., Mo.
**GRAVITATION AND THE STRUCTURE OF MATTER Ph.D. Thesis**
Robert Lee Pepin 1974 59 p
Avail: Univ. Microfilms Order No. 75-26301

The implications of the principle of the equivalence of mass and energy for Newton's theory of motion and gravitation are first examined. Because of the postulated equality between inertial and gravitational mass, this procedure leads to gravitational field equations where the Ricci tensor = 0. In an effort to account for the nature and structure of matter, field equations are proposed from which it follows that the curvature of space-time satisfies a Klein-Gordon type wave equation. An appropriate energy-momentum tensor is constructed. An exact solution of the proposed field equations is obtained for the case of static spherical symmetry. A feature of the solution is the quantization of charge. Findings suggest the possibility that when the field equations are solved for the case of stationary axial symmetry corresponding to the Kerr-Newman metric, the solution may provide a satisfactory explanation of the static properties of an isolated electron. Dissert. Abstr.

**N76-14996*#** National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
**GRAVITATIONAL COLLAPSE OF A TURBULENT VORTEX WITH APPLICATION TO STAR FORMATION**
Robert G. Deissler 25 Nov. 1975 30 p refs Presented at the Fluid Dyn. Meeting, College Park, Md., 24-25 Nov. 1975; sponsored by the Am. Phys. Soc.
(NASA-TM-X-71841; E-8525) Avail: NTIS HC $4.00 CSCL 03B

The gravitational collapse of a rotating cloud or vortex is analyzed by expanding the dependent variables in the equations of motion in two-dimensional Taylor series in the space variables. It is shown that the gravitation and rotation terms in the equations are of first order in the space variables, the pressure gradient terms are of second order, and the turbulent viscosity term is of third order. The presence of a turbulent viscosity insures that the initial rotation is solid-body-like near the origin. The effect of pressure on the collapse process is found to depend on the shape of the initial density disturbance at the origin. Dimensionless collapse times, as well as the evolution of density and velocity, are calculated by solving numerically the system of nonlinear ordinary differential equations resulting from the series expansions. The axial inflow plays an important role and allows collapse to occur even when the rotation is large. An approximate solution of the governing partial differential equations is also given; the equations are used to study the spacial distributions of the density and velocity. Author

# 91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

**N76-14997*#** Scientific Translation Service, Santa Barbara, Calif.
**SYMPOSIUM ON SCIENTIFIC SATELLITES (SYMPOSIUM ON SPACE OBSERVATION - 1975). SESSION 5: PLANS OF PLANETARY EXPLORATION, 2**
H. Otsuka et al Washington NASA Dec. 1975 42 p refs Transl. into ENGLISH from conf. paper from "Kagaku fisei symposium (Uchu kansoku symposium - showa 50 nen)" Session 5: Waku sei tan sa kei kaku, 2 p 129-154 Conf. held at Tokyo, 17-18 Apr. 1975
(Contract NASw-2791)
(NASA-TT-F-16699) Avail: NTIS HC $4.00 CSCL 03B

The significance and plans of planetary exploration are discussed. The investigations cover interplanetary space and Venus exploration, observations of the plasma, and remote exploration of the Venusian atmosphere. Conceptual plans for the Venus orbiter are presented. Author

**N76-14998*#** Scientific Translation Service, Santa Barbara, Calif.
**VENUS REVEALS SECRETS**
V. Alekseyev and S. Minchin Washington NASA Nov. 1975 135 p Transl. into ENGLISH of the book "Venera Raskryvayet Tayny" Moscow, Mashinostr. Press, 1975 p 1-96
(Contract NASw-2791)
(NASA-TT-F-16585) Avail: NTIS HC $6.00 CSCL 03B

The Soviet program of studying the planet Venus by means of automatic space stations is discussed. The history of investigations of Venus is traced beginning from ancient time up to the present day. The flight program of the stations Venera-1, Venera-2, Venera-3, Venera-4, Venera-5, Venera-6, Venera-7, which were able to discover the secrets of the planet and at the same time to solidify the possibilities for future investigations is described. The operation of the automatic space station Venera-8, which first studied the atmosphere and the surface of Venus on the illuminated side of the planet, is also discussed. Author

**N76-14999*#** Scientific Translation Service, Santa Barbara, Calif.
**ORIGIN OF THE MOON**
Ye. L. Ruskol Washington NASA Nov. 1975 224 p refs Transl. into ENGLISH of the book "Proiskhozhdeniye Luny" Moscow, Nauka Press, 1975 p 1-188
(Contract NASw-2791)
(NASA-TT-F-16623) Avail: NTIS HC $7.75 CSCL 03B

The problem of studying the early stages of evolution of the earth-moon system, including the formation of the moon, is considered. A theoretical model of the formation of the moon in the circumterrestrial swarm is discussed. Data on the moon, obtained by the methods of the earth sciences is summarized, the tidal evolution of the earth moon system is considered, and various hypotheses about the origin of the moon are surveyed and evaluated. A model of the formation of the moon is then considered: the generation of a circumterrestrial satellite swarm during the accumulation of the earth and the growth of the moon in the circumterrestrial satellite swarm. The origin of the satellites of the other planets of the solar system is considered.
Author

**N76-15000*#** Kanner (Leo) Associates, Redwood City, Calif.
**ARGON IN THE MARTIAN ATMOSPHERE. DO THE MARS-6 RESULTS AGREE WITH OPTICAL AND RADIO REFRACTION OBSERVATIONS?**
V. I. Moroz Washington NASA Dec. 1975 9 p refs Transl. into ENGLISH from Zh. Pisma v Astron. (Moscow), v. 1, no. 6, Jun. 1975 p 36-41
(Contract NASw-2790)
(NASA-TT-F-16823) Avail: NTIS HC $3.50 CSCL 03B

The detection of some inert gas in the Martian atmosphere, apparently argon, by the Mars-6 space probe is recounted. A combined analysis is conducted of infrared and ultraviolet spectrometric observations as well as results of radio-occultation measurements of the Martian atmosphere to determine the accuracy of the Mars-6 results. It is shown that all these data indicate an argon abundance of 25% to 35% in the Martian atmosphere.
Author

**N76-14548*** Cornell Univ., Ithaca, N.Y.
**SOLAR LUMINOSITY VARIATIONS AND THE CLIMATE OF MARS**
Owen B. Toon, Peter J. Gierasch, and Carl Sagan *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 179-184 refs (For availability see N76-14528 05-42)
(Grant NGR-33-010-220)
CSCL 03B

# 92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

**N76-15001** Maryland Univ., College Park.
**THE 2.2 MeV AND 0.51 MeV GAMMA-RAY LINE EMISSIONS FROM SOLAR FLARES Ph.D. Thesis**
Hsien Ta Wang 1975 106 p
Avail: Univ. Microfilms Order No. 75-28942

The formation of the 2.2 MeV and 0.51 MeV gamma ray lines for solar flares is calculated and the results are compared with observations of the August 4 and 7, 1972 flares. For the 2.2 MeV line, a Monte Carlo method is used for neutron and 2.2 MeV photon propagation in solar atmosphere, taking into account escape, decay and loss on He3 for neutrons, and Compton scattering for 2.2 MeV photons. For the 0.51 MeV line, the full energy spectrum of positrons from pion decay, the slowing down process of positrons, the mean life of positive beta emitting nuclei and the annihilation and positronium formations of the positrons in the ambient medium were taken into account. The main results are: the width of the 2.2 MeV line is very narrow and is not broadened by the Doppler and Compton effects, the 2.2 MeV photon yield per neutron is between about 0.05 to 0.2, and the time lags between the nuclear reactions and the formation of the 2.2 MeV and 0.51 MeV lines are caused by capture of the neutrons, and by deceleration of the positrons and decay of the radioactive nuclei.
Dissert. Abstr.

**N76-15002** California Univ., San Diego.
**SCINTILLATION STUDIES OF DENSITY MICROSTRUCTURE IN THE SOLAR WIND PLASMA Ph.D. Thesis**
John Knud Harmon 1975 105 p
Avail: Univ. Microfilms Order No. 75-29440

A technique for estimating the density power spectrum directly from the interplanetary scintillation observations (IPS) intensity spectrum is described. The estimation algorithm is applied to a large body of data obtained during 1972-73. Large fluctuations in the shape of the estimated density spectrum are interpreted as bias associated with the passage of high speed streams through the line of sight, rather than changes in the intrinsic shape of the spectrum. The distribution of microstructure in high speed streams was determined from a comparison between IPS data and plasma measurements made by the IMP-7 spacecraft during 1973. The IPS data were used to infer the location of regions of enhanced density microstructure, while the spacecraft data established the bulk density and velocity structure of the streams. It is found that regions of enhanced microstructure tend to lie behind density compressions but in front of the main body of the velocity stream.
Dissert. Abstr.

**N76-15003#** Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
**SCATTERING OF THE SOLAR LYMAN ALPHA LINE BY CARBON MONOXIDE**
Thomas Kassal Dec. 1975 20 p refs Submitted for publication
(RM-606) Avail: NTIS HC $3.50

The (14,0) band of the CO fourth positive system was shown to scatter the solar Lyman alpha emission line. This phenomenon is used to interpret planetary dayglows in the vacuum ultraviolet; a detailed calculation of the fluorescence spectrum due to this absorption process was made. It is shown that most of the energy is emitted between 1300 and 1500A. A detailed calculation of the absorption of the oxygen 1302A emission line by the (9,0) band was also included and it is shown that this process is almost negligible compared to the Lyman alpha scattering at high column densities.
Author

**N76-15004#** National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
**PROPAGATION AND DETECTION OF TURBULENCE GENERATED MHD WAVES IN THE LOWER SOLAR ATMOSPHERE**
Stephen J. Mangis Feb. 1975 58 p refs
(COM-75-11092/4; NOAA-TM-ERL-SEL-39; NOAA-75072307)
Avail: NTIS HC $4.50 CSCL 03B

Some basic solar concepts are developed and the limiting effects of the terrestrial atmosphere upon solar observations are investigated. Several theoretical aspects of MHD waves and the frequency spectrum of MHD waves generated by the hydrogen convection zone are discussed. The magnitudes of various observable characteristics of these waves are calculated, and there is a brief discussion of how it is hoped that these characteristics can be observed. It is concluded that the visual changes caused by turbulence generated MHD waves are of sufficient magnitude to be observed by orbiting telescopes now being developed, but that more work needs to be done to determine exactly how and where to observe these changes.
GRA

**N76-15005#** National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 370. PART 1 (PROMPT REPORTS). DATA FOR MAY 1975 - APRIL 1975. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975**
Hope I. Leighton Asheville, N. C. Jun. 1975 110 p
(COM-75-50193/370-1; SGD-370-Pt-1; NOAA-75072209)
Avail: NTIS MF $2.25; HC available from National Climatic Center, Attn: Publications, Federal Bldg., Asheville, N. C. 28801. Subscription $34.00/year includes Part 1 (Prompt Reports) and Part 2 (Comprehensive Reports); $18.00/year for either part. Annual supplement containing explanation is included. $1.40/

copy for either part; $1.30 for extra issue CSCL 03B

Prompt reports are given on data for May 1975 and April 1975. These deal with alert periods, daily solar indices, solar flares, solar radio waves, solar wind measurements, spacecraft observations, solar X-ray radiation, inferred IP magnetic field polarities, daily solar activity centers, sudden ionospheric disturbances, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

**N76-15006#** National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.
**SOLAR-GEOPHYSICAL DATA NUMBER 370. PART 2 (COMPREHENSIVE REPORTS). DATA FOR DECEMBER AND NOVEMBER 1974 AND MISCELLANEA. EXPLANATION OF DATA REPORTS ISSUED AS NUMBER 366 (SUPPLEMENT) FEBRUARY 1975**
Hope I. Leighton Asheville, N. C. Jun. 1975 33 p refs
(COM-75-50193/370-2; SGD-370-Pt-2; NOAA-75072209)
Avail: NTIS MF $2.25; HC available from National Climatic Center, Attn: Publications, Federal Bldg., Asheville, N. C. 28801. Subscription $34.00 year includes Part 1 (Prompt Reports) and Part 2 (Comprehensive Reports); $18.00/year for either part. Annual Supplement containing explanation is included. $1.40/copy for either part; $1.30 for extra issue CSCL 03B

Comprehensive reports are given on data for December and November 1974. These deal with solar flares, solar radio waves, magnetograms of geomagnetic storms, abbreviated calendar record and cosmic ray indices. GRA

**N76-15007#** Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
**A MODEL FOR THE SOLAR FLARE**
R. C. Canfield, E. R. Priest (St. Andrews Univ., Scotland), and D. M. Rust 10 Jul. 1975 13 p refs Presented at conf. at Natl. Center for Atmospheric Res., Boulder, Colo., 23-25 Sep. 1974 p 361-371 Submitted for publication
(AF Proj. 7649)
(AD-A013776; AFCRL-TR-75-0367) Avail: NTIS CSCL 03/2

It is suggested that many solar flares occur due to an interaction between newly emerging magnetic flux and an active region filament. A current sheet forms between the new and old flux and, when its electric current density exceeds a critical value, rapid magnetic fields reconnection takes place. Electrons are then accelerated to high energies and follow the magnetic field lines down to the chromosphere where they produce several (typically three) bright H alpha knots. Magnetic energy is continuously released as reconnected prominence fields are allowed to untwist. Two ribbons of H alpha emission are produced by one or more of three mechanisms: energetic particles, thermal conduction or shocks due to infalling material. GRA

**N76-14540*** Maryland Univ., College Park.
**SOLAR FLUX AND ITS VARIATIONS**
Elske V. P. Smith and David M. Gottlieb *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 97-117 refs (For availability see N76-14528 05-42)
(Grant NGL-21-002-033)
CSCL 03B

## 93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

**N76-15008** New York State Univ., Albany.
**THE CORRELATION OF RADIO EMISSION AND OPTICAL MORPHOLOGY IN PECULIAR GALAXIES Ph.D. Thesis**
Jack W. Sulentic 1975 130 p
Avail: Univ. Microfilms Order No. 75-28898

Radio surveys were made at 1400, 2700, and 5000 MHz of the majority of the systems in the Arp Atlas of Peculiar Galaxies. The principle aim of the study was to intercompare radio properties with optical morphology, although special emphasis was given the comparison of the multiple galaxies in the sample with both normal and peculiar single galaxies. Analysis of the radio and optical luminosity properties of the total sample suggest a separation into two populations. The first population is composed of the high luminosity radio galaxies which are primarily associated with optically luminous elliptical systems. The second population can be subdivided into multiple galaxies and single galaxies, the latter being the least luminous systems. Detailed comparison of the radio emitting galaxies in the sample with optical morphology revealed five classes into which most of the detected galaxies could be placed: single spiral and irregular classes and multiple systems of significantly different morphology. Dissert. Abstr.

**N76-15009#** Weapons Research Establishment, Salisbury (Australia).
**THE STRUCTURE OF PLASMA-DENSITY IRREGULARITIES IN THE INTERPLANETARY MEDIUM. 1: THEORY**
D. G. Singleton Jan. 1975 18 p refs
(WRE-TN-1315(WR/D)) Avail: NTIS HC $3.50

The conflict in the literature as to whether the plasma density spatial spectrum of the irregularities in the interplanetary medium is of Gaussian or power law form is discussed. Particular attention is given to the interplanetary scintillation effects ascribed to these irregularities. It is shown that the phase screen theory of scintillations can be invoked to devise a set of critical tests which provide a means of discriminating between the conflicting hypotheses. Differences in the predicted behavior of the single sensor temporal spectra of the scintillations for the two irregularity forms provide the main tests of the conflicting hypotheses. However, it is also shown that the two hypotheses lead to different forms of the variation of scintillation index with the observing frequency and the solar elongation of the scintillating source. Consideration is given to the optimum conditions for observing the Fourier and Bessel temporal spectra modulation which is due to Fresnel filtering of the spatial spectrum. Determination of irregularity shape, orientation and motion in terms of this modulation is also discussed. Author

**N76-15010#** Weapons Research Establishment, Salisbury (Australia).
**THE STRUCTURE OF PLASMA-DENSITY IRREGULARITIES IN THE INTERPLANETARY MEDIUM. 2: OBSERVATIONS**
D. G. Singleton Jan. 1975 26 p refs
(WRE-TN-1316(WR/D)) Avail: NTIS HC $4.00

Observations of the scintillation of sources 3C273 and 3C279 at 2292 MHz are described. The interpretation of the scintillation in terms of the structure of the plasma density irregularities in the interplanetary medium is discussed. Scintillation index measurements obtained during these observations are combined with similar measurements at other frequencies reported in the literature. The resulting variation of the scintillation-index and observing-frequency product with source elongation is interpreted in terms of irregularities with a spatial spectrum of electron density which is of power law form. This result is reinforced by an analysis of the spectra of the observed scintillations. Several tests are applied to both the Fourier and Bessel spectra which illustrate conclusively that the irregularity spatial spectrum is of power law form, rather than the Gaussian form suggested by some workers. Author

**N76-15011*#** California Inst. of Tech., Pasadena. George W. Downs Lab. of Physics.
**SUPPORT OF SELECTED X-RAY STUDIES TO BE PERFORMED USING DATA FROM THE UHURU (SAS-A) SATELLITE Final Report**
G. P. Garmire 8 Jan. 1976 28 p refs
(Grant NGR-05-002-296)
(NASA-CR-145835) Avail: NTIS HC $4.00 CSCL 03B

A new measurement of the diffuse X-ray emission sets more stringent upper limits on the fluctuations of the background and on the number counts of X-ray sources with absolute value of $b > 20$ deg than previous measurements. A random sample of background data from the Uhuru satellite gives a relative fluctuation in excess of statistics of 2.0% between 2.4 and 6.9 keV. The hypothesis that the relative fluctuation exceeds

2.9% can be rejected at the 90% confidence level. No discernable energy dependence is evident in the fluctuations in the pulse height data, when separated into three energy channels of nearly equal width from 1.8 to 10.0 keV. The probability distribution of fluctuations was convolved with the photon noise and cosmic ray background deviation (obtained from the earth-viewing data) to yield the differential source count distribution for high latitude sources. Results imply that a maximum of 160 sources could be between 1.7 and 5.1 x 10 to the -11 power ergs/sq cm/sec (1-3 Uhuru counts). Author

**N76-15012*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
**SAS-2 OBSERVATIONS OF THE GALACTIC GAMMA RADIATION FROM THE VELA REGION**
D. J. Thompson, G. F. Bignami, C. E. Fichtel, and D. A. Kniffen [1974] 11 p refs
(NASA-TM-X-72582) Avail: NTIS HC $3.50 CSCL 03B

Data from a scan of the galactic plane by the SAS-2 high energy gamma ray experiment in the region 250 deg < l2 < 290 deg show a statistically-significant excess over the general radiation from the galactic plane for gamma radiation of energy > 100 MeV in the region 260 deg < l2 < 270 deg and -7.5 deg < b2 > 0 deg. If the enhanced gamma radiation results from interactions of cosmic rays with galactic matter, as the energy spectrum suggests, it seems reasonable to associate the enhancement with large scale galactic features, such as spiral arm segments in that direction, or with the region surrounding the Vela supernova remnant, with which PSR 0833-45 is associated. If the excess is attributed to cosmic rays released from this supernova interacting with the interstellar matter in that region, then on the order of 3.10 to the 50th power ergs would be released by that supernova in the form of cosmic rays. Author

**N76-14545*** Polytechnic Inst. of New York.
**APPARENT RELATIONSHIP BETWEEN SOLAR SECTOR BOUNDARIES AND 300-MILLIBAR VORTICITY: POSSIBLE EXPLANATION IN TERMS OF UPWARD PROPAGATION OF PLANETARY-SCALE WAVES**
Raymond J. Deland *In* NASA. Goddard Space Flight Center Possible Relationships between Solar Activity and Meteorol. Phenomena 1975 p 163-165 (For availability see N76-14528 05-42)
CSCL 03B

# 99 GENERAL

**N76-15013#** National Bureau of Standards, Washington, D.C.
**DIMENSIONS/NBS. VOLUME 59: NUMBER 7, JULY 1975**
Jul. 1975 25 p
(COM-75-50141-07; NBS/DIM-59-7; LC-25-26527) Avail: NTIS MF $2.25; HC available from SOD as C13.13:59/7 CSCL 05B

Contents: Banking the environment; NBS studies ways to prevent and remove graffiti; Monitoring electric power networks for dollar savings and quality control; NBS tests buses, subway cars for fire safety; Product standards for a summer afternoon; centennial volume; Equipment facilities for shared use, fire research programs outlined; Computer symposium planned; New air conditioners save energy, money; Ethane data available; standard for APT programming language. GRA

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